



Weston Solutions, Inc.
1090 King Georges Post Road, Suite 201
Edison, New Jersey 08837-3703
Phone: 732-585-4400
www.westonsolutions.com

SUPERFUND TECHNICAL ASSESSMENT & RESPONSE TEAM V
EPA CONTRACT NO.: 68HE0319D0004

October 23, 2020

Mr. Pete Lisichenko, On-Scene Coordinator
U.S. Environmental Protection Agency, Region II
Superfund and Emergency Management Division
2890 Woodbridge Avenue
Edison, NJ 08837

EPA CONTRACT No: 68HE0319D0004
TD No: TO-0036-0073
DC No: STARTV-02-D-0055
SUBJECT: SITE-SPECIFIC UFP QUALITY ASSURANCE PROJECT PLAN
738 UPPER MOUNTAIN ROAD SITE
LEWISTON, NIAGARA COUNTY, NEW YORK

Dear Mr. Lisichenko,

Enclosed please find the Site-Specific Uniform Federal Policy (UFP) Quality Assurance Project Plan (QAPP) for the Removal Assessment activities to be conducted by the U.S. Environmental Protection Agency, Region II (EPA) with the support of Weston Solutions, Inc., Superfund Technical Assessment & Response Team V (START V) at the 738 Upper Mountain Road Site (the Site) located in Lewiston, Niagara County, New York. This plan covers the air monitoring and air and soil sampling activities to be conducted at the Site beginning October 26, 2020.

If you have any questions or comments, please do not hesitate to contact me at (732) 425-1175.

Sincerely,

WESTON SOLUTIONS, INC.

For: Sean Quinn
START V Site Project Manager

Enclosure:
cc: TD File: TO-0036-0073

an employee-owned company



In association with Eco-Risk, Pro-West & Associates, Inc., Avatar Environmental, LLC,
On-Site Environmental, Inc., and Sovereign Consulting, Inc.

SITE-SPECIFIC UFP QUALITY ASSURANCE PROJECT PLAN

738 UPPER MOUNTAIN ROAD SITE

Lewiston, Niagara County, New York

Site Code: A23N

CERCLIS Code: NYN000206697

Prepared by:

Superfund Technical Assessment & Response Team V
Weston Solutions, Inc.
Federal East Division
Edison, New Jersey 08837

Prepared for:

U.S. Environmental Protection Agency, Region II
Superfund and Emergency Management Division
2890 Woodbridge Avenue
Edison, New Jersey 08837

DC No: STARTV-02-D-0055

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October 2020

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- Figure 1: Site Location Map
- Figure 2: Area of Concern Map

ATTACHMENT B: Standard Operating Procedures

- ERT/SERAS SOP # 2001: General Field Sampling Guidelines
- ERT/SERAS SOP # 2011: Chip, Wipe and Sweep Sampling
- ERT/SERAS SOP # 2012: Soil Sampling
- ERT SOP # 2067: Operation of DataRAM
- ERT SOP # 2130: Operation of DryCal DC-Lite
- NYSDEC DER-10, Technical Guidance for Site Investigation and Remediation, May 3, 2010
- Field Sampling Protocols to Avoid Cross-Contamination at Perfluorinated Chemical Sites
- Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS)
NYSDEC Part 375 Remedial Program, October 2020

LIST OF ACRONYMS

ADR	Automated Data Review
ANSETS	Analytical Services Tracking System
AOC	Acknowledgment of Completion
ASTM	American Society for Testing and Materials
CEO	Chief Executive Officer
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CLP	Contract Laboratory Program
CFM	Contract Financial Manager
CO	Contract Officer
COI	Conflict of Interest
COO	Chief Operations Officer
CRDL	Contract Required Detection Limit
CRTL	Core Response Team Leader
CRQL	Contract Required Quantitation Limit
CQLOSS	Corporate Quality Leadership and Operations Support Services
CWA	Clean Water Act
DCN	Document Control Number
DI	Deionized Water
DPO	Deputy Project Officer
DQI	Data Quality Indicator
DQO	Data Quality Objective
EM	Equipment Manager
EDD	Electronic Data deliverable
ENVL	Environmental Unit Leader
EPA	Environmental Protection Agency
ERT	Environmental Response Team
FASTAC	Field and Analytical Services Teaming Advisory Committee
GC/ECD	Gas Chromatography/Electron Capture Detector
GC/MS	Gas Chromatography/Mass Spectrometry
HASP	Health and Safety Plan
HRS	Hazard Ranking System
HSO	Health and Safety Officer
ITM	Information Technology Manager
LEL	Lower Explosive Limit
LSASD	Laboratory Services and Applied Science Division
MSA	Mine Safety Appliances
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NELAC	National Environmental Laboratory Accreditation Conference
NELAP	National Environmental Laboratory Accreditation Program
NIOSH	National Institute for Occupational Safety and Health
NIST	National Institute of Standards and Technology
OSC	On-Scene Coordinator
OSHA	Occupational Safety and Health Administration

LIST OF ACRONYMS (Concluded)

OSWER	Office of Solid Waste and Emergency Response
PARCCS	Precision, Accuracy, Representativeness, Completeness, Comparability, Sensitivity
PAH	Polynuclear Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
PFAS	per- and poly-fluoroalkyl substances
PIO	Public Information Officer
PM	Program Manager
PO	Project Officer
PRP	Potentially Responsible Party
PT	Proficiency Testing
QA	Quality Assurance
QAL	Quality Assurance Leader
QAPP	Quality Assurance Project Plan
QMP	Quality Management Plan
QA/QC	Quality Assurance/Quality Control
QC	Quality Control
RC	Readiness Coordinator
RCRA	Resource Conservation and Recovery Act
RPD	Relative Percent Difference
RSCC	Regional Sample Control Coordinator
RST	Removal Support Team
SARA	Superfund Amendments and Reauthorization Act
SEDD	Staged Electronic Data Deliverable
SOP	Standard Operating Practice
SOW	Statement of Work
SPM	Site Project Manager
START	Superfund Technical Assessment & Response Team
STR	Sampling Trip Report
TAL	Target Analyte List
TD	Technical Direction Document
TDL	Technical Direction Letter
TO	Task Order
TQM	Total Quality Management
TSCA	Toxic Substances Control Act
UFP	Uniform Federal Policy
VOA	Volatile Organic Analysis

TABLE 1: Crosswalk

Optimized UFP-QAPP Worksheets		2106-G-05 QAPP Guidance Section	
A. Project Management and Objectives			
1 & 2	Title and Approval Page	2.2.1	Title, Version, and Approval/Sign-Off
3 & 5	Project Organization and QAPP Distribution	2.2.3	Distribution List
		2.2.4	Project Organization and Schedule
4, 7, & 8	Personnel Qualifications and Sign-Off Sheet	2.2.1	Title, Version, and Approval/Sign-Off
		2.2.7	Special Training Requirements and Certifications
6	Communication Pathways	2.2.4	Project Organization and Schedule
9	Project Planning Session Summary	2.2.5	Project Background, Overview, and Intended Use of Data
10	Conceptual Site Model (CSM)	2.2.5	Project Background, Overview, and Intended Use of Data
11	Project/Data Quality Objectives	2.2.6	Data/Project Quality Objectives and Measurement Performance Criteria
12	Measurement Performance Criteria	2.2.6	Data/Project Quality Objectives and Measurement Performance Criteria
13	Secondary Data Uses and Limitations	Chapter 3	QAPP ELEMENTS FOR EVALUATING EXISTING DATA
14 & 16	Project Tasks & Schedule	2.2.4	Project Organization and Schedule
15	Project Action Limits and Laboratory-Specific Detection/Quantitation Limits	2.2.6	Data/Project Quality Objectives and Measurement Performance Criteria
B. Measurement/Data Acquisition			
17	Sampling Design and Rationale	2.3.1	Sample Collection Procedure, Experimental Design, and Sampling Tasks
18	Sampling Locations and Methods	2.3.1	Sample Collection Procedure, Experimental Design, and Sampling Tasks
		2.3.2	Sampling Procedures and Requirements
19 & 30	Sample Containers, Preservation, and Hold Times	2.3.2	Sampling Procedures and Requirements
20	Field Quality Control (QC) Sample Summary	2.3.5	QC Requirements
21	Field Standard Operating Procedures (SOPs)	2.3.2	Sampling Procedures and Requirements

TABLE 1: Crosswalk (Concluded)

Optimized UFP-QAPP Worksheets		2106-G-05 QAPP Guidance Section	
B. Measurement/Data Acquisition			
22	Field Equipment Calibration, Maintenance, Testing, and Inspection	2.3.6	Instrument/Equipment Testing, Calibration and Maintenance Requirements, Supplies and Consumables
23	Analytical SOPs	2.3.4	Analytical Methods Requirements and Task Description
24	Analytical Instrument Calibration	2.3.6	Instrument/Equipment Testing, Calibration and Maintenance Requirements, Supplies and Consumables
25	Analytical Instrument and Equipment Maintenance, Testing, and Inspection	2.3.6	Instrument/Equipment Testing, Calibration and Maintenance Requirements, Supplies and Consumables
26 & 27	Sample Handling, Custody, and Disposal	2.3.3	Sample Handling, Custody Procedures, and Documentation
28	Analytical QC and Corrective Action	2.3.5	QC Requirements
29	Project Documents and Records	2.2.8	Document and Records Requirements
C. Assessment/Oversight			
31, 32, & 33	Assessments and Corrective Action	2.4	ASSESSMENTS AND DATA REVIEW (CHECK)
		2.5.5	Reports to Management
D. Data Review			
34	Data Verification and Validation Inputs	2.5.1	Data Verification and Validation Targets and Methods
35	Data Verification Procedures	2.5.1	Data Verification and Validation Targets and Methods
36	Data Validation Procedures	2.5.1	Data Verification and Validation Targets and Methods
37	Data Usability Assessment	2.5.2	Quantitative and Qualitative Evaluations of Usability
		2.5.3	Potential Limitations on Data Interpretation
		2.5.4	Reconciliation with Project Requirements

QAPP Worksheet #1& 2: Title and Approval Page


1. Project Identifying Information

- a) **Site Name/Project Name:** 738 Upper Mountain Road Site
b) **Site Location/No.:** Lewiston, Niagara County, New York / NYN000206697
c) **Contract/Work Assignment No.:** 68HE0319D0004 / TDD#: 0036-0073

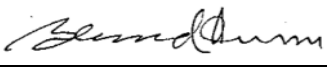
2. Lead Organization

Weston Solutions, Inc.
1090 King Georges Post Road, Suite 201
Edison, New Jersey 08837


Lead Organization's Site Project Manager:

Sean Quinn		10/23/2020
Printed Name/Title	Signature	Date

Lead Organization's Technical Review:

Bernard Nwosu		10/23/2020
Printed Name/Title	Signature	Date

Lead Organization's QA/QC Chemist:

Smita Sumbaly		10/23/2020
Printed Name/Title	Signature	Date

EPA Region II On-Scene Coordinator:

Pete Lisichenko		
Printed Name/Title	Signature	Date

EPA Region II Quality Assurance Officer:

Printed Name/Title	Signature	Date

Document Control Number: START V-02-D-0055

QAPP Worksheet #1& 2: Title and Approval Page (Concluded)

3. List plans and reports from previous investigation relevant to this project.

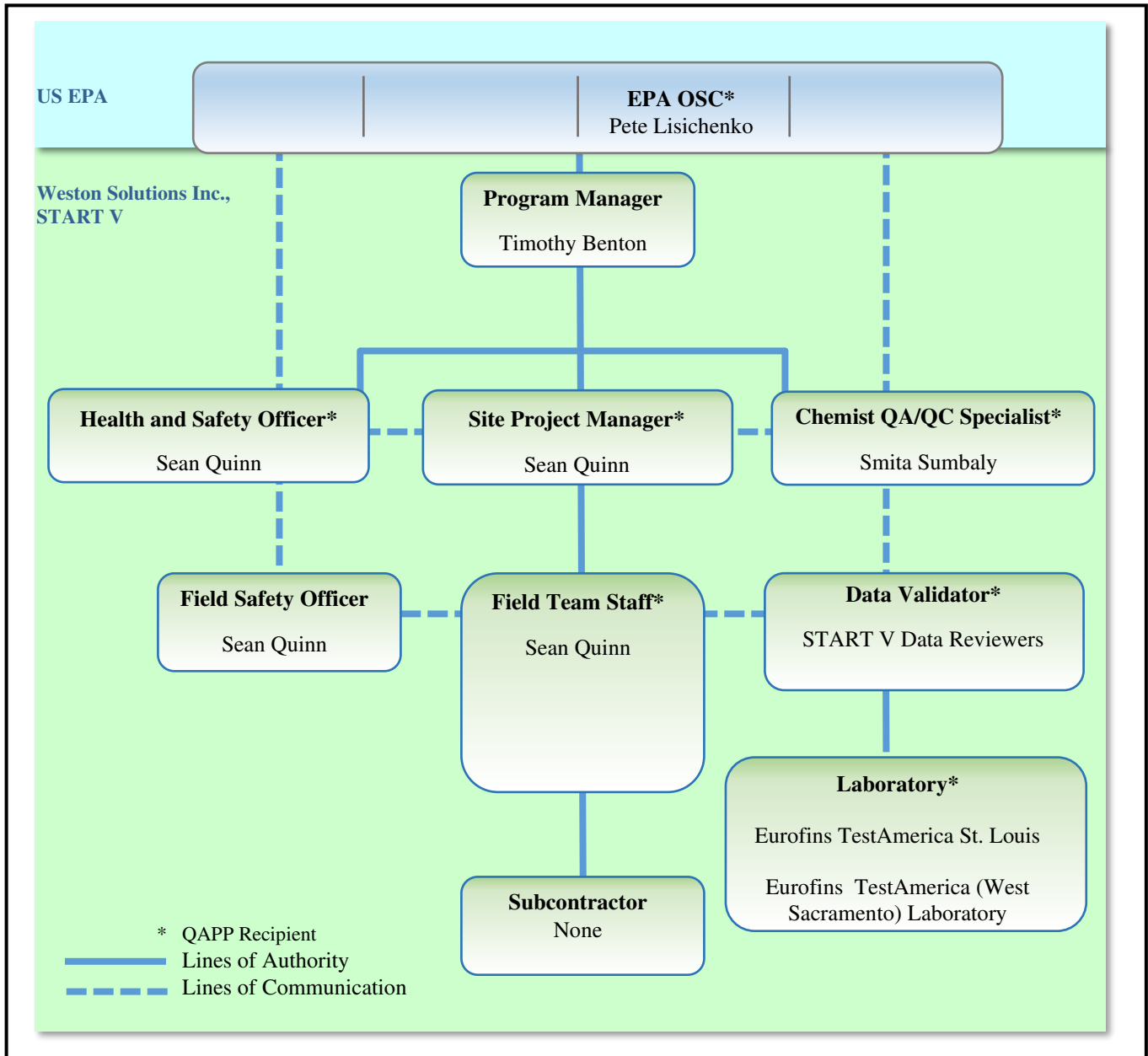
Site-Specific UFP Quality Assurance Project Plan, 738 Upper Mountain Road Site (DC No: RST3-03-D-0102), November 8, 2016.

Site-Specific UFP Quality Assurance Project Plan, 738 Upper Mountain Road Site (DC No: STARTV-01-D-0084), October 16, 2019.

Exclusions:

Worksheet # 12 and 28 not required for air and wipe samples.

QAPP Worksheet #3 & 5: Project Organizational and QAPP Distribution



Acronyms:

EPA – U.S. Environmental Protection Agency
 OSC – On-Scene Coordinator
 QA/QC – Quality Assurance/Quality Control
 START V – Superfund Technical Assessment & Response Team V
 QAPP – Quality Assurance Project Plan

QAPP Worksheet #3 & 5: Project Organizational and QAPP Distribution (Concluded)

QAPP Recipient	Title	Organization	Telephone Number	Fax Number	E-mail Address	Document Control Number
Pete Lisichenko	OSC	EPA, Region II	(347)-276-6251	Not Applicable	Lisichenko.Peter@epa.epamail.gov	STARTV-02-D-0055
Sean Quinn	SPM	Weston Solutions, Inc., START V	(732)-585-4411	Not Applicable	Sean,quinn@westonsolutions.com	STARTV-02-D-0055
Smita Sumbaly	QAO	Weston Solutions, Inc., START V	(732) 585-4410	Not Applicable	S.Sumbaly@westonsolutions.com	STARTV-02-D-0055
Bernard Nwosu	HSO	Weston Solutions, Inc., START V	(732) 585-4413	Not Applicable	Ben.Nwosu@westonsolutions.com	STARTV-02-D-0055
Site TD File	START V Site TDD File	Weston Solutions, Inc., START V	Not Applicable	Not Applicable	Not Applicable	STARTV-02-D-0055

QAPP – Quality Assurance Project Plan
EPA – U.S. Environmental Protection Agency
OSC – On-Scene Coordinator
SPM – Site Project Manager
START V – Superfund Technical Assessment & Response Team V
QAO – Quality Assurance Officer
HSO – Health & Safety Officer
TD – Technical Direction

QAPP Worksheet #4, 7 & 8: Personnel Qualification and Sign-off Sheet


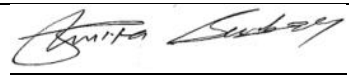
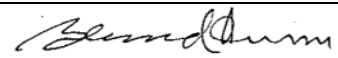
Project Function	Specialized Training By Title or Description of Course	Training Provider	Training Date	Personnel / Groups Receiving Training	Personnel Titles / Organizational Affiliation	Location of Training Records / Certificates ¹	Date of Training
[Specify location of training records and certificates for samplers]							
QAPP Training	This training is presented to all START V personnel to introduce the provisions, requirements, and responsibilities detailed in the UFP QAPP. The training presents the relationship between the site-specific QAPPs, SOPs, work plans, and the Generic QAPP. QAPP refresher training will be presented to all employees following a major QAPP revision.	Weston Solutions, Inc., (In House Training)	As needed	All START V field personnel upon initial employment and as refresher training	Weston Solutions, Inc.	Within Division	February 2020
Health & Safety Training	Health and safety training will be provided to ensure compliance with Occupational Safety and Health Administration (OSHA) as established in 29 CFR 1910.120.	Weston Solutions, Inc., (In House Training)	Yearly at a minimum	All Employees upon initial employment and as refresher training every year	Weston Solutions, Inc.	Within Division	February 2020
Others	Scribe, ICS 100 and 200, and Air Monitoring Equipment Trainings provided to all employees	EPA ERT (In-House Training) FEMA (On-line Training) Weston Solutions, Inc., (In House training)	Upon initial employment and as needed				February 2020
	Dangerous Goods Shipping	Weston Solutions, Inc., (In House Training)	Every 3 years				April 2019

All team members are trained in the concepts and procedures in recognizing opportunities for continual improvement, and the approaches required to improve procedures while maintaining conformance with legal, technical, and contractual obligations.

¹All members, including subcontractors, certifications are in possession of Health & Safety Officer.

QAPP Worksheet #4, 7 & 8: Personnel Qualification and Sign-off Sheet (Concluded)

Organization: Weston Solutions, Inc., START V

Name*	Project Title/Role	Education and Experience Qualifications	Specialized Training/Certifications	Organizational Affiliation	Signature	Date
Sean Quinn	SPM, START V	3+ years*	Implementing and executing the technical, QA and health and safety during sampling event, sample collection and sample management.	Weston Solutions, Inc.		10/23/2020
Smita Sumbaly	QAO, START V	30 years*	Chemist QA/QC Specialist	Weston Solutions, Inc.		10/23/2020
Bernard Nwosu	HSO, START V	25+ years*	Health and Safety Officer	Weston Solutions, Inc.		10/23/2020

*All START V members and subcontractor's resumes are in possession of Program Manager, EPA Project Officer, and Contracting Officers

SPM – Site Project Manager

START V – Superfund Technical Assessment & Response Team V

QAO – Quality Assurance Officer

HSO – Health & Safety Officer

QA/QC – Quality Assurance/Quality Control

Organization: EPA Region II

Name	Project Title/Role	Education and Experience Qualifications	Specialized Training/Certifications	Organizational Affiliation	Signature	Date
Pete Lisichenko	EPA OSC	NA	All project coordination, direction and decision making.	EPA, Region II		

EPA – U.S. Environmental Protection Agency

OSC – On-Scene Coordinator

QAPP Worksheet #6: Communication Pathways

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure
Point of contact with EPA OSC	SPM, Weston Solutions, Inc., START V	Sean Quinn	(732) 425-1175 (732) 585-4411	All technical, QA and decision-making matters in regard to the project (verbal, written or electronic)
Adjustments to QAPP	SPM, Weston Solutions, Inc., START V	Sean Quinn	(732) 425-1175 (732) 585-4411	QAPP approval dialogue
Health and Safety On-Site Meeting	HSO, Weston Solutions, Inc., START V	Sean Quinn	(732) 425-1175 (732) 585-4411	Explain Site hazards, personnel protective equipment, hospital location, etc.
Lab Data Quality Issues (including sample receipt variances and laboratory quality control variances)	Eurofins TestAmerica St. Louis	Frank Mike	(314) 298-8566	Laboratories PM's will report any issues with project samples to WESTON Chemist QA/QC Specialist within 1 business day of notification. The WESTON Chemist QA/QC Specialist will contact the field sampler if necessary to resolve sample receiving discrepancies.
Data verification and data validation issues	STARTV Data Validator and subcontracted CHP/Data Validator	Smita Sumbaly	(732) 585-4410	The START V Data Validator/ subcontracted CHP will review non-CLP data verification and validation.
Analytical Corrective Actions	WESTON Chemist QA/QC Specialist START V Data Validator or Laboratory PMs	Smita Sumbaly	(732) 585-4410	If laboratories corrective actions are necessary, the WESTON Chemist QA/QC Specialist will communicate with laboratory project manager.
Data Tracking and Management, Release of Analytical Data	WESTON SPM WESTON Operations Manager	Sean Quinn Bernard Nwosu	(732) 425-1175 (732) 585-4411 (732) 585-4413	The need for corrective actions will be determined by the SPM upon review of the data. No analytical data will be released prior to validation and all releases must be approved by the Chemist QA/QC Specialist, SPM and EPA OSC/TM.

OSC: On-Scene Coordinator
SPM: Site Project Manager
HSO: Health and Safety Officer
RSCC: Regional Sample Control Coordinator
ESAT: Environmental Services Assessment Team
TBD – To Be Determined

QAPP Worksheet #9: Project Planning Session Summary

Date of Planning Session: 10/09/2020				
Location: Phone Call				
Purpose: Scoping meeting for UFP-QAPP for EPA Region II Superfund Technical Assessment & Response Team V				
Name	Title/Role	Organization	E-mail Address	Phone No.
Pete Lisichenko	EPA OSC	EPA	Lisichenko.peter@epa.epamail.gov	(347)-276-6251
Sean Quinn	START V	WESTON	Sean.quinn@WestonSolutions.com	(732)-585-4411

Site-Specific Initial Scoping Meeting Notes/Comments:

Weston Solutions, Inc., Superfund Technical Assessment & Response Team V (START V) has been tasked by the U.S. Environmental Protection Agency, Region II (EPA) with providing support for Removal Action activities at the 738 Upper Mountain Road Site (the Site) located in Lewiston, New York. The anticipated scope of work (SOW) includes community air monitoring for PM₁₀ (particulate matter smaller than 10 microns) using Dataram particulate air monitors, air sampling for particulates using RADēCO volumetric air samplers with filter media attachment, post-excavation confirmation soil sampling, and conformation wipe sampling.

The SOW for soil sampling activities will include the collection of clean fill samples for laboratory analysis from a fill material vendor selected by EPA. Up to three clean fill samples, including quality assurance/quality control (QA/QC) samples, will be collected from the clean fill facility's stockpile of 2-inch crusher run. The clean fill samples will be analyzed for per- and poly-fluoroalkyl (PFAS) substances by the assigned laboratory to verify that the fill material meets the requirements of the New York State Department of Environmental Conservation (NYSDEC) for imported fill. In addition, up to 20 post-excavation confirmation soil samples, including QA/QC samples, will be collected during excavation activities on-site. The post-excavation soil samples will be analyzed by the assigned laboratory for radiochemistry, including gamma spectroscopy and alpha spectroscopy, to verify that residual radiological materials are not remaining on-site.

Air monitoring utilizing Dataram particulate air monitors will consist of continuous, real-time air quality monitoring and data collection. Monitoring locations will be upwind, at areas of intrusive site activity (i.e., excavation), and downwind. The air monitoring stations will be linked via EPA's VIPER system (a wireless network-based communications system) which will provide instantaneous real-time air quality readings through a computer server. The air monitoring data generated will assist in determining if the dust suppression measures being utilized on-site are effective at maintaining dust levels below the Site-Specific Action Levels (SSALs).

RADēCO volumetric air samplers will be deployed at each air monitoring station to collect up to 10 ambient air samples which will be analyzed on-site for radioactive dust (alpha and beta) particles by EPA's Health Physicist (HP) using Ludlum Model 3030 (Ludlum-3030) Alpha Beta counter. Analytical results of the air samples will be used to verify the effectiveness of dust suppression measures being utilized on-site and to ensure site personnel and nearby residences are not being exposed to site-related airborne contaminants.

QAPP Worksheet #9: Project Planning Session Summary (Concluded)

Wipe samples will be collected from the exterior of cubic yard boxes and super sacks, if utilized on-site for waste management, in order to verify that any dust particulates on the exterior surfaces do not contain radiological materials above the SSALs prior to offsite disposal. Wipe samples will also be collected from decontaminated equipment to verify that decontamination procedures effectively remove all site-related contaminants below the SSALs before decommissioning the equipment from the Site. Up to 30 wipe samples will be collected.

Consensus Decisions Made:

Clean fill samples will be collected from the New Enterprise Stone & Lime Co. Inc., located at 8615 Wehrle Drive in Williamsville, New York using field sampling materials that meet the PFAS sampling protocol checklist, and sampling will be performed in accordance with Division of Environmental Remediation-10 (DER-10) and the *Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS)* protocol stipulated in NYSDEC's Part 375 Remedial Program, October 2020. Analytical results of the clean fill samples will be compared with the NYSDEC Residential Use Soil Cleanup Objectives (RUSCO) for Perfluorooctanoic acid (PFOA) and Perfluorooctanesulfonic acid (PFOS) in order to verify that the fill material meets the regulatory requirement for use as imported fill on-site.

Post-excavation confirmation sampling will be performed in accordance with EPA's *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)* and NYSDEC *Division of Environmental Remediation (DER)-10, Technical Guidance for Site Investigation and Remediation* (May 3, 2010). Analytical results of the post-excavation confirmation soil samples will be compared with the EPA Site-Specific Preliminary Remediation Goals (PRGs) for soil radiochemistry to verify that the Removal Action objective is met.

Analytical results of the air and wipe samples will be compared with their respective SSALs as determined by the EPA HP. All monitoring and sampling activities associated with the Removal Action are scheduled to begin on the week of October 26, 2020.

Action Items:

Action	Responsible Party	Due Date
Prepare CLP Analytical Request Form	SPM, START V	10/09/2020
Prepare START V Analytical Request Form	SPM, START V	10/09/2020
Develop Health and Safety Plan	SPM, START V	10/23/2020
Develop Quality Assurance Project Plan	SPM, START V	10/23/2020
Develop Work Plan (driller, sampler, survey, etc.)	SPM, START V	Not Applicable
Develop Equipment List	SPM, START V	10/19/2020
Develop Site-Specific Data Management Plan	SPM, START V	10/23/2020

QAPP Worksheet #10: Conceptual Site Model

Background Information:

The Site is situated at 738 Upper Mountain Road in Lewiston, New York and the geographic coordinates are 43.15553, -79.02245. The Site consists of a small area of concern (AOC) with radionuclide contamination approximately 1,493 square feet (ft²), and is located on the vacant, approximately 10.2 acre parcel 115.08-1-27 owned by Talarico Bros. Building Corp (TBBC). The AOC is located at the entrance of the driveway currently utilized by the 738 Upper Mountain Road residence although the driveway was historically used as an access road to the vacant TBBC property. The residence is on a separate property from the AOC. The Site is bordered to the north by Upper Mountain Road, residential properties, and a further wooded area; to the east and west by residential properties; and to the south by a wooded area.

In July 1985, members of the Radiological Survey Activities (RASA) group at Oak Ridge National Laboratory (ORNL) performed a radiological survey of 738 Upper Mountain Road and documented a maximum gamma exposure rate of 710 microroentgens per hour (μ R/hr). The area where this reading was collected is approximately 10 feet wide by 59 feet in length along a ditch and gravel residential driveway. The survey showed that the 738 Upper Mountain Road anomaly is associated with the asphalt driveway that contained a phosphate slag material. This rocky-slag waste material was used for bedding under asphalt surfaces and in general gravel applications at the Site and 61 other locations in the Niagara Falls area identified by ORNL.

Biased surface soil samples collected in conjunction with the study indicated the presence of radium-226 (Ra-226), uranium-238 (U-238), and thorium-232 (Th-232) at the Site. The subsequent November 1986 report stated that all the contaminated soil and rock samples collected had approximately equal concentrations of Ra-226 and U-238, which suggests that the rocks probably originated from a singular source. The origin of the thorium-bearing material was unknown; the report postulated that its source was from some type of mineral extraction activity in the Niagara Falls area. The report stated that the 738 Upper Mountain Road anomaly was not related to materials connected with Niagara Falls Storage Site (NFSS), including materials that were transported to NFSS.

During a reconnaissance performed by the New York State Department of Health (NYSDOH) and New York State Department of Environmental Conservation (NYSDEC) on July 9, 2013, screening activities showed radiation levels at 300 μ R/hr with a hand-held pressurized ion chamber (PIC) and 105,000 to 110,000 counts per minute (cpm) with a sodium iodide (NaI) 2x2 scintillation detector; the singular reading was taken at the end of the driveway adjacent to Upper Mountain Road.

On December 12, 2013, Weston Solutions, Inc., Site Assessment Team (SAT), currently Superfund Technical Assessment & Response Team V (START V), collected a total of nine soil samples and two slag samples from the Site. At each sample location, soil samples were collected directly beneath slag material; at locations where a radioactive layer was not present the soil sample was collected at the equivalent depth interval. The slag samples consisted of pulverized silty sand with rocks, cobbles, and gravel (*i.e.*, radioactive waste material mixture) rather than singular pieces of slag. The soil and slag samples, and aqueous rinsate blank, were

QAPP Worksheet #10: Conceptual Site Model (Continued)

analyzed for target analyte list (TAL) metals, including mercury; isotopic thorium, isotopic uranium, Ra-226, and radium-228 (Ra-228) by alpha spectroscopy; and other radioisotopes by gamma spectroscopy. Analytical results indicated concentrations of radionuclides found in the slag and soil to be significantly higher than at background conditions.

On May 1 and 2, 2014, SAT collected radon and thoron concentration measurements from locations on and in the vicinity of the Site. The radon and thoron measurements were collected at heights of one meter above the ground surface. During the May 2014 air monitoring event, background radon concentrations were measured at 0.16 +/- 0.13 picocuries per liter (pCi/L) (to account for maximum background concentrations, the uncertainty value is added to the background measurement for an adjusted concentration of 0.29 pCi/L) during the morning hours on May 2, 2014 and an adjusted value of 0.12 pCi/L during the afternoon hours on May 1, 2014. Background thoron concentrations were calculated to be 0.060 pCi/L (adjusted concentration) during the morning hours on May 2, 2014 and an adjusted value of 0.15 pCi/L during the afternoon hours on May 1, 2014. There were no radon or thoron concentrations that exceeded the site-specific background, nor were there any adjusted concentrations that equaled or exceeded a value two standard deviations above the mean site-specific background concentrations for these radionuclides in ambient air.

On October 25, 2016, the U.S. Environmental Protection Agency, Region II (EPA) and Weston Solutions, Inc., Removal Support Team 3 (RST 3) conducted radiological survey inside the one residence located in proximity to the AOC and exterior areas of the Site. A hand-held NaI 3x3 scintillator attached to a Ludlum-2241 gamma meter was utilized to conduct radiological survey in the residence, and an all-terrain vehicle (ATV) with a Ludlum-2241 and NaI 3x3 scintillator setup connected to a wireless network-based communication system was utilized to conduct mobile ground radiological survey throughout the Site and areas surrounding the residence. Gamma readings collected within the residence were at background levels (10 to 12 μ R/hr). Exterior gamma reading generally ranged from background to less than three time (3x) background except at a small area of the driveway entrance currently utilized by the 738 Upper Mountain Road residence where gamma readings were as high as 462.2 μ R/hr.

On November 18, 2016, EPA and RST 3 continued Removal Assessment activities at the Site. Based on radiological survey measurements collected during the October 2016 Removal Assessment event, test pits were advanced on-site to depths of 2 feet below ground surface (bgs) at four location selected by EPA. A total of 17 heterogeneous samples of soil/slag/rock, including quality assurance/quality control (QA/QC) samples, were collected from the side walls of each test pit at 6 inch intervals from 0 to 6, 6 to 12, 12 to 18, 18 to 24 inches bgs.

In December 2016, RST 3 utilized a High-purity Germanium (HPGe) detector to perform quantitative gamma spectrometry analysis of the heterogeneous samples of soil/slag/rock collected from the Site in November 2016. Subsequently, all the heterogeneous samples of soil/slag/rock were submitted to the assigned laboratory for bismuth-212 (Bi-212), cesium-137 (Cs-137), potassium-40 (K-40), lead-212 (Pb-212), protactinium (Pa-234), Ra-226, Ra- 228, Th-228, Th-230, Th-232, Th-234, thallium-208 (Tl-208), U-233/234, U-235/236, U-235, and U-238, analyses.

QAPP Worksheet #10: Conceptual Site Model (Continued)

The analytical results were compared with the SSALs established by EPA in March 2019 for the target radioisotopes. Based on analytical results, the concentrations of Pa-234M and Th-228 exceeded the respective EPA SSALs in nine samples with exceedance concentrations identified in at least one depth interval from 0 to 24 inches bgs at all four test pit locations. In addition, the concentrations of Bi-212, Pb-212, Ra-226, Ra-228, Tl-208, Th-230, Th-232, Th-234, U-233/234, and U-238, exceeded the EPA SSALs in all the samples collected from one particular test pit location. Furthermore, analytical and radiological survey results were utilized to estimate the volume of contaminated soil at the AOC. The vertical extent of the radiological contamination was estimated at 2 feet bgs based on radionuclide exceedance concentrations from analytical results, and the impacted surface area was estimated at 128.11 square meters (1,378.98 square feet) based on radiological survey results where gamma readings exceeded 3x background. Approximately 102.15 cubic yards of contaminated soil is estimated to be present at the AOC on-site.

On August 11 through 14, 2017, personnel from RST 3-procured National Radon Safety Board (NRSB)-certified Company, Accu-View Property Inspections (Accu-View), performed radon sampling in the one residence located in proximity to the AOC. A total of eight activated charcoal canisters (radon canisters), including one field duplicate, were deployed for radon sampling at the residence. When compared with the EPA Action Level of 4.0 pCi/L for radon, analytical results indicated radon concentrations were below the EPA Action Level.

On October 22, 2019, START V visited the facility of a fill material vendor, New Enterprise Stone & Lime Co. Inc., and collected four grab clean fill samples, including one field duplicate, and two composite clean fill samples, including one field duplicate, from a fill material stockpile located on the facility. All the clean fill samples were submitted to the assigned laboratories for Target Analyte List (TAL) Volatile Organic Compounds (VOCs), TAL Semivolatile Organic Compounds (SVOCs), TAL pesticides, and TAL Polychlorinated Biphenyls (PCBs), TAL metals including mercury (Hg), cyanide (CN), gamma spectrometry, alpha spectrometry, and isotopic uranium and thorium, analyses.

Analytical results indicated that, TCL VOCs, TCL SVOCs, TCL pesticides, and TCL PCBs, TAL metals including mercury, cyanide, and target radionuclides, were either not detected, or detected at concentrations well below their respective EPA Removal Management Level (RMLs), NYSDEC Unrestricted Use Soil Cleanup Objectives (UUSCOs), and the SSALs for target radionuclides.

On October 23, 2019, START V utilized dedicated stainless-steel hand augers to advance one soil boring at the on-site AOC to a depth of 24 inches bgs. Two disposal soil samples, including one field duplicate, were collected from the boring at depths 0 to 12 inches bgs and one disposal soil sample was collected from the boring at depths 12 to 24 inches bgs. The disposal soil samples comprised of soil/slag/rocks. All the disposal soil samples were submitted to the assigned laboratories for TCL VOCs, TCL SVOCs, TCL pesticides, and TCL PCBs, TAL metals including mercury, cyanide, gamma spectrometry, alpha spectrometry, and isotopic uranium and thorium,

QAPP Worksheet #10: Conceptual Site Model (Concluded)

Toxicity Characteristic Leaching Procedure (TCLP) VOCs, TCLP SVOCs, and TCLP pesticides, TCLP herbicides, and TCLP metals including mercury, analyses. Analytical results of the disposal soil samples were compared with EPA RMLs for residential soil, EPA SSALs for the target radioisotopes, and EPA Maximum Concentration of Contaminants (MCCs) for the toxicity characteristic as determined by TCLP. Analytical results indicated that, TCL VOCs, TCL SVOCs, TCL pesticides, and TCL PCBs, TAL metals including, mercury and cyanide, target radionuclides, TCLP VOCs, TCLP SVOCs, and TCLP pesticides, TCLP herbicides, and TCLP metals including mercury, were either not detected, or detected at concentrations well below their respective EPA RMLs, SSALs for target radionuclides, and EPA MCCs. Reactive cyanide, reactive sulfide, and burn rate were negative, and soil pH at depth 0 to 24 inches bgs was slightly basic at 8.6.

Utilizing a Ludlum-2241 and NaI Scintillator setup, EPA collected gamma readings at the second access road area of the TBBC property located between the 786 Upper Mountain Road and 776 Upper Mountain Road properties in order to verify that there were no slag deposits near the roadway similar to the access road currently utilized by the 738 Upper Mountain Road property. Gamma readings around the second access road of the TBBC property was within background levels, approximately 8,000 cpm.

QAPP Worksheet #11: Project/Data Quality Objectives

1. State the Problem:

Based on previous radiological surveys and sampling events performed during several site assessment and Removal Assessment events, radiological contamination has been confirmed to be present at the Site. The selected remedy for the Site is the excavation and off-site disposal of the contaminated soil and material. Therefore, EPA plans to initiate a Removal Action at the Site and has requested the support of START V to conduct on-Site air monitoring and perform clean fill, post-excavation soil, and air and wipe sampling for laboratory analysis.

2. Identify the Goals of the Study:

- Clean fill sampling will be performed at an off-site clean fill vendor's facility. Clean fill samples will be analyzed by the assigned laboratory for PFAS. Analytical results of the fill material will be compared with the NYSDEC RUSCO for PFOA and PFOS to verify that the fill material meets the regulatory requirement for use as imported fill on-site. If analytical results exceeds the regulatory limits, then EPA will consider sampling fill material at another vendor's facility.
- Post-excavation confirmation sampling will be performed on-site as excavation activities progress. Post-excavation soil samples will be analyzed by the assigned laboratory for alpha spectroscopy and gamma spectroscopy, including Ra-226 (21 days ingrowth). Prior to backfilling the excavation, Ludlum-2241 with NaI 3x3 scintillator will be utilized to complete a full gamma scan of the excavated area to verify that there are no residual radiological materials in the excavation. Analytical results of post-excavation soil samples will be compared with the Site-Specific PRGs to verify that the Removal Action objective is met.
- Air monitoring for PM₁₀ will be performed upwind, at areas of intrusive site activity, and downwind using Dataram particulate air monitors. Air monitoring will consist of continuous, real-time air quality monitoring and data collection via the EPA's VIPER system, which will provide instantaneous real-time air quality readings. The air monitoring data generated will assist in determining if the dust suppression measures being utilized on-site are effective at maintaining dust levels below the SSALs. If air monitoring readings exceed the SSALs, then EPA will initiate corrective action to remedy the cause of the exceedance.
- Air sampling will be performed throughout removal operations on-site using RADēCO volumetric air samplers, which will be deployed at each air monitoring station to collect ambient air samples in filter media. Air filter samples will be analyzed on-site for radioactive dust (alpha and beta) particles by EPA's HP using Ludlum-3030. Analytical results of the air samples will be used to verify the effectiveness of dust suppression measures being utilized on-site and ensure site personnel and nearby residences are not being exposed to site-related airborne contaminants. If analytical results exceed the Site-Specific Action Level of alpha and beta particles, then EPA will reappraise site activities, including dust suppression measures, and initiate corrective action to remedy the cause of the exceedance.

QAPP Worksheet #11: Project/Data Quality Objectives (Continued)

- Wipe samples will be collected from the exterior of cubic yard boxes and super sacks, if utilized on-site for waste management, before being placed into storage containers (Conex boxes). In addition, wipe samples will be collected from surfaces of decontaminated equipment before they are decommissioned from the Site. The wipe samples will be analyzed on-site by the EPA HP and analytical results compared to the SSALs. If analytical results of the wipe samples collected from the cubic yard boxes and super sacks exceed the SSALs of alpha and beta particles, then EPA will reappraise the dust suppression measures and initiate corrective action. If the analytical results of the equipment wipe samples exceed the SSALs of alpha and beta particles, then the equipment will be decontaminated again and resampled.

3. Identify Information Inputs:

Up to three grab clean fill samples, including one field duplicate, and additional sample volumes designated for matrix spike/matrix spike duplicate (MS/MSD) analyses, will be collected from an off-site fill material vendor for PFAS analysis. According to NYSDEC's Part 375 remedial program document, if PFOA or PFOS is detected in any sample at or above 1 ug/kg, then soil should be tested for synthetic precipitation leaching procedure (SPLP). Up to twenty post-excavation confirmation soil samples, including one field duplicate, and additional sample volumes designated for MS/MSD analyses, will be collected from excavations for radiochemistry analysis, including gamma spectroscopy for Th-234, Pa-234 or Pa-234m, Pb-214, and Bi-214 from the uranium decay chain, Ra-228 and/or actinium-228 (Ac-228), Ra-224, Pb-212, Bi-212, and Tl-208 from the thorium decay chain, other gamma emitting radioisotopes including Cs-137 and K-40, and Ra-226 using Bi-214 and/or Pb-214 homogenized for 21 day ingrowth, and alpha spectroscopy for U-233/234, U-235/236, U-238, Th-230, Th-232, and Th-228. The clean fill and post-excavation soil samples will be collected for definitive data objective.

4. Define the Boundaries of the Study:

Overall project objectives include:

To utilize analytical results to determine if the selected fill material meets the regulatory requirement for use as imported fill on-site. To utilize analytical results to verify that all radiological material have been excavated from the Site in order to meet the Removal Action objective. To utilize analytical results to verify that dust suppression measures being utilized on-site are effective at keeping site personnel and nearby residences safe from being exposed to site-related airborne contaminants. To utilize analytical results to verify that equipment is properly decontaminated before being decommission from the Site.

Who will use the data? Data will be used by EPA, Region II OSC.

5. Develop the Analytic Approach:

Analytical Techniques:

Clean fill samples: PFAS and SPLP by EPA Method 537.1

QAPP Worksheet #11: Project/Data Quality Objectives (Continued)

Post-excavation soil samples: Gamma spectroscopy by EPA Method 901.1, alpha spectroscopy by HASL 300/GA-01-R, other gamma emitting radioisotopes by HASL-300/A-01-R

Type of Data: Definitive data

Matrix: Clean fill (2-inch crusher run) and Soil

Parameters:

Up to three clean fill samples, including one field duplicate for PFAS analysis.

Up to 10 air filter samples for alpha and beta particle count.

Up to 30 wipe samples for alpha and beta particle count.

Up to 20 post-excavation soil samples, including one field duplicate, for radiochemistry analyses

Gamma Spectrometry – homogenized with 21-day ingrowth

- Ra-226 using Bi-214 and/or Pb-214 (if only one progeny radionuclide is used, either Bi-214 or Pb-214, provide the other radionuclide's activity)
- From the Uranium Decay Chain: Th-234, Pa-234m
- From the Thorium Decay Chain: Ra-228 and/or Ac-228, Ra-224, Pb-212, Bi-212, Tl-208
- Other gamma emitting radionuclides: Cs-137 and K-40

Alpha Spectrometry – total dissolution of the sample to ensure complete homogenization of dense, rock-like contaminant in sample

- Isotopic Uranium: U-233/234, U-235/236, U-238
- Isotopic Thorium: Th-230, Th-232, Th-228

Field Monitoring/Screening Equipment: Dataram particulate air monitors, Ludlum 2241 with 3x3 scintillator with shielding (screening data, radiological screening of soil)

Sampling Equipment:

Air sampling: RADeCO volumetric air samplers with filter media.

Post-excavation soil sampling: disposable plastic scoops, re-sealable plastic bags, and HDPE or glass sample containers.

Clean fill sampling: dedicated stainless steel scoops and pans, and laboratory procured sample containers.

Wipe sampling: Ghost wipes, 10x10 sampling template, and re-sealable plastic bags

Access Agreement: Obtained by EPA, Region II OSC.

Sampling Locations: Sample locations will be identified by the EPA OSC.

How much data are needed? Up to three clean fill soil samples, including field duplicate and MS/MSD samples and up to twenty post-excavation confirmation soil samples, including field duplicate and MS/MSD samples will be collected for off-site laboratory analysis. Up to 10 air samples and up to 30 wipe samples will be collected for on-site alpha and beta particle count.

6. Specify Performance or Acceptance Criteria:

How “good” does the data need to be in order to support the environmental decision?

Sampling/analytical measurement performance criteria (MPC) for Precision, Accuracy, Representativeness, Completeness, and Comparability (PARCC) parameters will be established. Refer to Worksheet #12, criteria for performance measurement for definitive data.

QAPP Worksheet #11: Project/Data Quality Objectives (Concluded)

Where, when, and how should the data be collected/generated?

Up to three grab soil samples, including QA/QC samples, will be collected at an off-site vendor facility and up to twenty grab post-excavation confirmation soil samples, including QA/QC samples, will be collected from excavation areas on-site. The sampling event is scheduled to begin on October 26, 2020 and will be completed within a week. All field and sampling activities will be performed in accordance with methods outlined in EPA's ERT/Scientific, Engineering, Response and Analytical Services (SERAS) contractor's Standard Operating Procedures (SOPs) and the Field Sampling Protocols to Avoid Cross-Contamination at Perfluorinated Chemicals (PFC) Sites.

7. Develop the Detailed Plan for Obtaining Data

Who will collect and generate the data? The clean fill samples will be collected by START V and submitted to TestAmerica (West Sacramento) Laboratory for PFAS analysis. The post-excavation soil samples will be collected by START V and submitted to Eurofins TestAmerica St. Louis for radiochemistry (gamma spectroscopy and alpha spectroscopy) analysis. The analytical data for clean fill (PFAS) samples will be generated by TestAmerica (West Sacramento) Laboratory and validated by START V data validation personnel. The analytical data for post-excavation soil (radiochemistry) samples will be generated by Eurofins TestAmerica St. Louis and validated by subcontracted CHP data validation personnel.

How will the data be reported? All data will be reported by the assigned laboratory (Preliminary, Electronic, and Hard Copy format). The Site Project Manager will provide a Sampling Trip Report, Status Reports, Maps/Figures, Analytical Report, and Data Validation Report to the EPA OSC.

How will the data be archived? Electronic data deliverables will be archived in a Scribe database.

QAPP Worksheet #12: Measurement Performance Criteria
QAPP Worksheet #12A1: Gamma Spectrometry by EPA Method 901.1 (Non-CLP Worksheet)

Matrix: Soil

Analytical Group/Method: Radiochemistry (Gamma Spectrometry)

Concentration Level: Medium (Activity per Gram)

Data Quality Indicators (DQIs)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria¹
Bias/Contamination	Method Blank	No radionuclides detected above the target detection limit (MDC)
Accuracy/Bias	LCS	Recovery limits as specified in Worksheet #28A
Precision	Sample Duplicate	RPD Limit of 40% or Normalized Difference < 3

QAPP Worksheet #12: Measurement Performance Criteria
QAPP Worksheet #12A2: Alpha Spectroscopy - HASL 300/A-01-R (Non-CLP Worksheet)

Matrix: Soil

Analytical Group/Method: Radiochemistry (Alpha Spectroscopy)

Concentration Level: Medium (Activity per Gram)

Data Quality Indicators (DQIs)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria ¹
Bias/Contamination	Method Blank	No radionuclides detected above the target detection limit (MDC)
Accuracy/Bias	LCS	Recovery limits as specified in Worksheet #28B
Precision	Sample Duplicate	RPD Limit of 40% or Normalized Difference < 3
Accuracy/Bias	Tracer (every sample)	Recovery limits of 30-110%

QAPP Worksheet #12: Measurement Performance Criteria (Concluded)
QAPP Worksheet #12B: PFAS (Non-CLP Worksheet)

Matrix Soil
Analytical Group¹ PFAS
Concentration Level Low

Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance
Precision Accuracy	Recoveries should be within 70-130%. ≤ 30 % RPD.	LCS control spike
Accuracy	Peak area counts for all ISs in all injections must be within +/- 50% of the average peak area calculated during the initial calibration.	Internal Standards
Accuracy	Recoveries should be within 70-130%, RPD ≤ 30 %.	Matrix Spike/Matrix Spike Duplicate
Accuracy	70-130 % of the true value.	Surrogate Compounds
Accuracy	Demonstrate that all method analytes are below the RL.	Method Blank
Precision	RPD ≤ 30 %	Field Duplicate

Note: For analytical method see QAPP Worksheet #23.

QAPP Worksheet #13: Secondary Data Criteria and Limitations

Any data needed for project implementation or decision making that are obtained from non-direct measurement sources such as computer databases, background information, technologies and methods, environmental indicator data, publications, photographs, topographical maps, literature files and historical data bases will be compared to the DQOs for the project to determine the acceptability of the data. Thus, for example, analytical data from historical surveys will be evaluated to determine whether they satisfy the validation criteria for the project and to determine whether sufficient data was provided to allow an appropriate validation to be done. If not, then a decision to conduct additional sampling for the site may be necessary.

Data Type	Data Source (Originating Organization, Report Title, and Date)	Data Uses Relative to Current Project	Factors Affecting the Reliability of Data and Limitations on Data Use
EPA Removal Assessment, August 2016 and 2017	RST 3 Removal Assessment Sampling Report; 2016 and 2017 Events; March 26, 2019; DC No: RST3-05-F-0075	To guide decisions for current events based on site history, background, and recent and ongoing events at the Site.	To verify the presence of residual radiological contamination in soil, identify potential releases of radiation- containing materials in soil and fill material, determine additional radiation source areas, and delineate the extent of on-site radiological contamination.
EPA Removal Assessment, October 2019	START V Final Removal Assessment Sampling Report, June 4, 2020; DC No.: STARTV-01-F-0076	To guide decisions for current events based on site history, background, and recent and ongoing events at the Site.	To verify the presence of residual radiological contamination in soil, identify potential releases of radiation- containing materials in soil and fill material, determine additional radiation source areas, and delineate the extent of on-site radiological contamination.

QAPP Worksheet #14 & 16: Project Tasks and Schedules

Activity	Responsible Party	Planned Start Date	Planned Completion Date	Deliverable(s)	Deliverable Due Date
Develop Project-Specific Health and Safety Plan (HASP)	WESTON	10/13/2020	10/19/2020	HASP	10/19/2020
Develop Project-Specific QAPP/Revisions	WESTON	10/13/2020	10/23/2020	QAPP	10/23//2020
Coordination with EPA Region II RSCC for Regional or CLP analytical support or procure WESTON-subcontracted laboratory for analytical services	WESTON	10/09/2020	10/15/2020	Region II RSCC documentation (laboratory assignment) or WESTON Purchase Order for analytical services	NA
Scoping meeting Operations Manager, SPM, HSO, and sampling team to discuss data collection activities, objectives, and logistics	WESTON	10/09/2020	10/09/2020	Meeting Notes	10/09/2020
Mobilization/Demobilization	WESTON	10/25/2020	10/30/2020	Field Notes	NA
Sample Collection Tasks	WESTON	10/25/2020	10/30/2020	Field Notes	NA
Analytical Tasks	WESTON	11/02/2020	11/23/2020	Field Notes/Laboratory Reports	11/23/2020
Quality Control Tasks	WESTON	11/02/2020	11/23/2020	Report of Analyses/Data Package	11/23/2020
Data Validation	WESTON	11/23/2020	12/14/2020	Validation Summary Report	12/14/2020
Summarize Data	WESTON	12/15/2020	12/22/2020	Project-Specific Summary Report/Table	12/22/2020
Develop Project-Specific Report	WESTON	12/15/2020	12/29/2020	Draft Project-Specific Report	12/29/2020
Address EPA comments on Draft Project-Specific Report	WESTON	12/30/2020	1/13/2021	Project-Specific Report	1/13/2021
Contract Closeout	WESTON	7/1/2020	6/30/2021	Contract Closeout Report	6/30/2021

Note: All dates listed above are approximate dates, actual deliverable will be provided based on sampling date and the date analytical data will be received from the lab.
NA – Not Applicable

QAPP Worksheet #14 & 16: Project Tasks and Schedules (Continued)

Sampling Tasks:

START V has been tasked by EPA with providing field sampling support for the collection of up to three clean fill samples, including one field duplicate, and additional sample volumes designated for MS/MSD, from a fill material vendor located off-site for PFAS analysis and SPLP testing; and the collection of up to 20 post-excavation confirmation soil samples, including one field duplicate, and additional sample volumes designated for MS/MSD, from excavation areas on-site for radiochemistry analysis. START V will also conduct air monitoring, collect up to 10 air filter samples throughout removal activities, and collect up to 30 wipe samples from surfaces of cubic yard boxes, super sacks, and decontaminated equipment for on-site analysis using Ludlum-3030.

Analysis Tasks:

Soil - PFAS and SPLP:	EPA Method 537.1 modified
Soil - Gamma Spectrometry:	EPA Method 901.1
Soil - Radium 226 (21 Day Ingrowth)	EPA Method 901.1
Soil - Alpha Spectroscopy:	HASL 300/A-01-R
Air/Wipe - Alpha/Beta count	Not Applicable

Decontamination: Dedicated sampling equipment will be utilized for both clean fill and post-excavation soil sampling; therefore, decontamination of sampling equipment will not be necessary. However, in accordance with EPA Method 537.1 for PFAS analysis, equipment/rinsate blank will be collected during clean fill sampling.

Quality Control Tasks:

Clean fill and post-excavation soil samples will be collected for definitive data and QA/QC purposes, therefore, field duplicate and additional sample volumes for MS/MSD analysis will be collected at a frequency of one per 20 field samples per matrix. In accordance with EPA modified Method 537.1 for PFAS and SPLP analysis, although dedicated sampling equipment will be utilized, equipment/rinsate blank will be collected for clean fill samples.

Data Management Tasks: Activities under this project will be reported in status and trip reports and other deliverables (e.g., analytical reports, final reports) described herein. Activities will also be summarized in appropriate format for inclusion in monthly and annual reports. The following deliverables will be provided under this project:

Trip Report: A trip report will be prepared to provide a detailed accounting of what occurred during each sampling mobilization. The trip report will be prepared within two weeks of the last day of each sampling mobilization. Information will be provided on time of major events, dates, and personnel on-site (including affiliations).

Maps/Figures: Maps depicting site layout, contaminant source areas, and sample locations will be included in the trip report, as appropriate.

QAPP Worksheet #14 & 16: Project Tasks and Schedules (Continued)

Analytical Report: An analytical report will be prepared for samples analyzed under this plan. Information regarding the analytical methods or procedures employed, sample results, QA/QC results, chain-of-custody documentation, laboratory correspondence, and raw data will be provided within this deliverable.

Data Review: A review of the data generated under this plan will be undertaken. The assessment of data acceptability or usability will be provided separately, or as part of the analytical report.

Documentation and Records:

All sample documents will be completed legibly, in ink. Any corrections or revisions will be made by lining through the incorrect entry and by initialing the error.

Field Logbook: The field logbook is essentially a descriptive notebook detailing site activities and observations so that an accurate account of field procedures can be reconstructed in the writer's absence. Field logbook will be bound and paginated. All entries will be dated and signed by the individuals making the entries, and should include (at a minimum) the following

1. Site name and project number
2. Name(s) of personnel on-site
3. Dates and times of all entries (military time preferred)
4. Descriptions of all site activities, site entry and exit times
5. Noteworthy events and discussions
6. Weather conditions
7. Site observations
8. Sample and sample location identification and description*
9. Subcontractor information and names of on-site personnel
10. Date and time of sample collections, along with chain of custody information
11. Record of photographs
12. Site sketches
13. GPS Coordinates for each sample location

* The description of the sample location will be noted in such a manner as to allow the reader to reproduce the location in the field at a later date.

Sample Labels: Sample labels will clearly identify the particular sample, and should include the following:

1. Site/Project number
2. START V Sample identification number.
3. Sample collection date and time
4. Analytical Parameters
5. Sample preservation

QAPP Worksheet #14 & 16: Project Tasks and Schedules (Concluded)

Sample labels will be written in indelible ink and securely affixed to the sample container. Tie-on labels can be used if properly secured.

Custody Seals: Custody seals demonstrate that a sample container has not been tampered with or opened. The individual in possession of the sample(s) will sign and date the seal, affixing it in such a manner that the container cannot be opened without breaking the seal. The name of this individual, along with a description of the sample packaging, will be noted in the field logbook.

Assessment/Audit Tasks: No performance audit of field operations is anticipated at this time. If conducted, performance and system audit will be in accordance with the project plan.

Data Review Tasks: All non-CLP data will be validated by the Weston data validator and subcontracted CHP data validators.

The data generated under this QA/QC Sampling Plan will be evaluated according to guidance in the Uniform Federal Policy for Implementing Environmental Quality Systems: Evaluating, Assessing and Documenting Environmental Data Collection and Use Programs Part 1: UFP-QAPP (EPA-105-B-04-900A, March 2005); Part 2B: Quality Assurance/Quality Control Compendium: Minimum QA/QC Activities (EPA-105-B-04-900B, March 2005). Laboratory analytical results will be assessed by the data reviewer for compliance with required precision, accuracy, completeness, representativeness, and sensitivity.

Laboratory analytical results will be assessed by the data reviewer for compliance with required precision, accuracy, completeness, representativeness, and sensitivity.

**QAPP Worksheet #15: Project Action Limits and Laboratory Specific
Detection/Quantitation Limits
Worksheet #15A: Radiochemistry**

Matrix: Soil

Analytical Group: Gamma Spec-GA-01-R/Alpha Spec-A-01-R

Concentration Level: Medium

Analyte Description	CAS Number	Site-Specific Action Level* (pCi/g)	Method Detection Limit (mg/L)
Gamma Spec – GA-01-R			
Actinium-228	14331-83-0	5.01	1.00
Bismuth-212	14913-49-6	5.01	3.00
Bismuth-214	14733-03-0	NS	1.00
Cesium-137	10045-97-3	28.40	0.200
Lead-212	15092-94-1	5.01	0.300
Lead-214	15067-28-4	NS	1.00
Potassium-40	13966-00-2	83.30	1.50
Protactinium-234	378783-76-7	5.18	1.50
Radium-224	13233-32-4	NS	5.00
Radium-226 ¹	13982-63-3	5.18	1.00
Radium-228	15262-20-1	5.01	1.00
Thallium-208	14913-50-9	5.01	0.200
Thorium-234	15065-10-8	5.18	4.00
Isotopic Uranium (Alpha Spec) A-01-R			
Uranium-233/234	13966-29-5	5.18	1.00
Uranium-235/236	15117-96-1	21.10	1.00
Uranium-238	7440-61-1	5.18	1.00
Isotopic Thorium (Alpha Spec) – A-01-R			
Thorium-228	14274-82-9	5.01	1.00
Thorium-230	14269-63-7	5.18	1.00
Thorium-232	7440-29-1	5.01	1.00

*Data will be compared with the Site-Specific Action Levels established by EPA in March 2019

pCi/g – Picocuries per gram

¹Ra-226 via 21 day ingrowth

**QAPP Worksheet #15: Project Action Limits and Laboratory Specific
Detection/Quantitation Limits
Worksheet #15B: PFAS (Non-CLP)**

Matrix: Soil
Analytical Group: PFAS
Concentration Level: Low

Analyte	CAS Number	Project Quantification Limit*	NYSDEC RUSCO (PFAS) (ppb)	Achievable Laboratory	
				MDLs* µg/kg	RLs µg/kg
Perfluorobutanoic acid (PFBA)	375-22-4	Not Applicable	See Attachment B	0.0280	0.200
Perfluoropentanoic acid (PFPeA)	2706-90-3			0.0770	0.200
Perfluorohexanoic acid (PFHxA)	307-24-4			0.0420	0.200
Perfluoroheptanoic acid (PFHpA)	375-85-9			0.0290	0.200
Perfluorooctanoic acid (PFOA)	335-67-1			0.0860	0.200
Perfluorononanoic acid (PFNA)	375-95-1			0.0360	0.200
Perfluorodecanoic acid (PFDA)	335-76-2			0.0220	0.200
Perfluoroundecanoic acid (PFUnA)	2058-94-8			0.0360	0.200
Perfluorododecanoic acid (PFDoA)	307-55-1			0.0670	0.200
Perfluorotridecanoic acid (PFTriA)	72629-94-8			0.0510	0.200
Perfluorotetradecanoic acid (PFTeA)	376-06-7			0.0540	0.200
Perfluorobutanesulfonic acid (PFBS)	375-73-5			0.0250	0.200
Perfluorohexanesulfonic acid (PFHxS)	355-46-4			0.0310	0.200
Perfluoroheptanesulfonic Acid (PFHpS)	375-92-8			0.0350	0.200
Perfluorooctanesulfonic acid (PFOS)	1763-23-1			0.200	0.500
Perfluorodecanesulfonic acid (PFDS)	335-77-3			0.0390	0.200
Perfluorooctanesulfonamide (FOSA)	754-91-6			0.0820	0.200
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	2355-31-9			0.390	2.00
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	2991-50-6			0.370	2.00
6:2 FTS	27619-97-2			0.150	2.00
8:2 FTS	39108-34-4			0.250	2.00

Samples will be compared with New York State Department of Environmental Conservation (NYSDEC) Residential Use Soil Cleanup Objectives (RUSCO) documented in Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS) NYSDEC Part 375 Remedial Program, October 2020. Refer to Attachment B.

**QAPP Worksheet #15: Project Action Limits and Laboratory Specific
Detection/Quantitation Limits
Worksheet #15C: Wipe Sample**

Matrix: Air/Wipe

Analytical Group: Alpha and Beta Particles

Concentration Level: Trace

Analyte	Action Limit Air (dpm)	Action Limit Wipe (dpm)
Alpha	9	9
Beta	400	400

dpm – disintegrations per minute

**QAPP Worksheet #15: Project Action Limits and Laboratory Specific
Detection/Quantitation Limits (Concluded)
Worksheet #15D: Particulate Monitoring**

Matrix: Air

Analytical Group: Not Applicable

Concentration Level: Trace/Low

Analyte	CAS Number	Range	Resolution	Action Level
Total Particulates (PM ₁₀)	Not applicable	0.001 to 150 mg/m ³ (Dataram)	+/- 0.1 % of reading or 0.001 mg/m ³ (Dataram)	0.15 mg/m ³ (Dataram)

QAPP Worksheet #17: Sampling Design and Rationale

All field sampling activities will be conducted in accordance with EPA's ERT/SERAS contractor's SOP Number (No.): 2001: *General Field Sampling Guidelines*.

Clean fill Sampling for PFAS:

Clean fill sampling for PFAS analysis will be performed in accordance with EPA's ERT/SERAS contractor's SOP No. 2012: *Soil Sampling* and the *Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS)* protocol stipulated in the NYSDEC Part 375 Remedial Program, October 2020. Clean fill samples will be collected from stockpile of 2-inch crusher run located on the selected fill material vendor's facility. Up to three clean fill samples, including one field duplicate, and additional sample volumes designated for MS/MSD analyses, will be collected from the stockpile. The number of samples to be collected is in accordance with NYSDEC Division of Environmental Remediation-10 (DER-10) based on the volume of soil to be excavated/backfilled on-site, which is approximately 100 cubic yards (yd³). Prior to sampling, the Weston PFAS sampling protocol checklist will be completed in order to prevent potential contamination of the samples with PFAS. Donning nitrile gloves at each sampling location, clean fill samples will be collected using dedicated stainless steel scoops. The samples will be homogenized in dedicated stainless steel pans/bowl/container prior to being transferred into sample containers to be provided by the assigned laboratory. In accordance with the sampling SOP, one equipment/rinsate blank will be collected and submitted along with the clean fill samples for PFAS analysis. Following sample collection, all sample information will be entered into the Site-Specific SCRIBE database from which chain of custody (COC) record and sample labels will be printed. Refer to the attached Field Sampling Protocols to Avoid Cross-Contamination at Perfluorinated Chemicals (PFC) Sites.

Air Sampling:

Air sampling will be conducted daily at each air monitoring station using RADēCO (Model H-810) volumetric air samplers calibrated by the manufacturer and equipped with replaceable filter media. Each air sampler contains a 2-inch filter holder with a RADēCO (0750-37) glass fiber air filter. The air samplers will be set to collect air filter samples at a flow rate of 5 cubic feet per minute (cfm) for a target volume of 2,400 cubic feet (cf) over an approximately 8-hour period. Each day, the air samplers will be calibrated using the RADēCO Air Calibrator (Model D-828) prior to being deployed. Calibration readings will be recorded using the RADēCO (Model H-810) Calibration Functional Check Form F001. Calibration forms will be reviewed and maintained on-site by the EPA HP prior to air sampler being deployed in the field.

Each RADēCO unit will be mounted on a tripod stand, powered with an electric generator, and positioned in an opposing wind direction. Air filter samples will be collected daily from perimeter air monitoring locations upon initiation of intrusive activities (excavation) and periodically as needed depending on changes in Site conditions, expected elevated contaminant concentrations in soils being excavated, and if analytical results of previous air samples indicate there is a need for further sampling. All air filter samples collected will be placed in a glassine envelop before being placed in a re-sealable plastic bag. Air sampling information, including date, start and stop time, start and ending flow rates, and total volume will be entered into the Site-Specific SCRIBE

QAPP Worksheet #17: Sampling Design and Rationale (Concluded)

database. All information collected from each air sampler will be documented using Sample Control Form and Chain of Custody Form F002. Documentation associated with the sample, including Forms F001 and F002, will be kept with the sample until relinquished to the EPA HP for on-site analysis utilizing a Ludlum-3030.

Wipe Sampling:

Wipe sampling will be performed in accordance with SOP No. 2011: *Chip, Wipe and Sweep Sampling*. Wipe samples will be collected from the exterior of cubic yard boxes and super sacks, if utilized on-site for waste management, in order to verify that any dust particulates on the exterior surfaces do not contain radiological materials above the Site-Specific Action Levels prior to offsite disposal. Wipe samples will also be collected from decontaminated equipment to verify that decontamination procedures effectively removed all contamination below Site-Specific Action Levels before removing the equipment from the Site. Each wipe sample will be collected within a 100 square centimeters (cm²) sampling template. Donning new nitrile gloves, the wipe sampling media (*i.e.*, ghost wipe) will be opened and stroked firmly over the sample surface in a reproducible pattern, first vertically, then horizontally, to ensure complete coverage. The wipe sample will be folded and placed into a re-sealable plastic bag and labelled. All sample information will be entered into the Site-Specific SCRIBE database from which COC record and sample labels will be printed. Up to 30 wipe samples will be collected and analyzed on-site for alpha and beta particles by the EPA HP using Ludlum-3030.

Post-Excavation Soil Sampling:

Soil sampling will be conducted in accordance with EPA's ERT/SERAS contractor's SOP No. 2012: *Soil Sampling*, EPA's MARSSIM, NYCRR Part 375, and NYSDEC DER-10 (May 3, 2010). At a minimum, post-excavation soil samples were collected at a frequency of one sidewall soil sample per 30 linear feet of the excavation perimeter and one bottom soil sample at a frequency of one per 900 sq. ft. Post-excavation samples will be collected using dedicated disposable scoops, and fresh nitrile gloves will be donned between each sampling location. Prior to sample collection at each location, the bottom of the scoop will be used to scrape each area of the sidewall and floor, in order to expose fresh soil which will then be collected, placed directly into re-sealable plastic bags, homogenized in the plastic bags, and then placed into polyurethane or glass sample containers. For QA/QC purposes, field duplicate, and additional sample volumes for MS/MSD analyses, will be collected at a frequency of one per 20 field samples. Since dedicated sampling equipment will be utilized, rinsate blank will not be required. All sample information will be entered into the Site-Specific SCRIBE database from which COC record and sample labels will be printed. The soil samples will be submitted to the assigned laboratory for gamma spectroscopy and alpha spectroscopy, analyses.

The following sampling design is based on information currently available and may be modified on-site based on other acquired information.

QAPP Worksheet #17: Sampling Design and Rationale (Concluded)

The following laboratories will provide the analyses indicated:

Lab Name/Location	Sample Type	Parameters
Eurofins TestAmerica St. Louis 13715 Rider Trail North Earth City, MO 63045-1205 Laboratory Contact: Frank Mike RFP# 634 (non-CLP Lab)	Soil	Gamma Spectrometry Alpha Spectrometry
Eurofins TestAmerica (West Sacramento) Laboratory 880 Riverside Pkwy, West Sacramento, CA 95605 Laboratory Contact: TBD Phone: (916) 373-5600 RFP# 634A (non-CLP Lab)	Clean fill	PFAS

Refer to Worksheet #20 for QA/QC samples, sampling methods, and SOPs.

QAPP Worksheet #18: Sampling Locations and Methods/SOP Requirements

The following information is project-specific and will be included in the site-specific QAPP.

Sampling Location	Matrix	(Units)	Sample Type No. of Samples (identify field duplicates)	Analyte/Analytical Group(s)	Sampling SOP Reference ¹	Comments
3	Clean Fill	ppb	2 (1)	PFAS (PFOA & PFOS)	SOP# 2001 SOP# 2012 NYSDEC DER-10 ² NYSDEC Part 375 ³	To verify if the fill material meets the requirements of the NYSDEC UUSCO in accordance with NYCRR 375. Follow PFAS sampling protocols
20	Soil	pCi/g	19 (1)	Gamma spectrometry, Alpha Spectrometry, and Isotopic	SOP# 2001 SOP# 2012 MARSSIM ⁴	Verify that there is no radiological material remaining within the excavated area.
10	Air	dpm	10 (0)	Alpha Beta Count	SOP # 2011	To verify that dust suppression measures are effective at reducing dust fugitive dust.
30	Wipe	dpm	50 (0)	Alpha Beta Count	SOP # 2011	To verify that dust suppression measures are effective at reducing dust accumulation of surfaces of waste material storage containers. To verify that field equipment is properly decontaminated before being decommissioned off-site

PPB – parts per billion

pCi/g – Picocuries per gram

dpm - Disintegrations per minute

¹The website for EPA's ERT/SERAS SOPs is: https://response.epa.gov/site/site_profile.aspx?site_id=2107

²The website for NYSDEC DER-10 is: https://www.dec.ny.gov/docs/remediation_hudson_pdf/der10.pdf

³NYSDEC Part 375: https://www.dec.ny.gov/docs/remediation_hudson_pdf/pfassampanaly.pdf

⁴The website for MARSSIM is: <https://www.epa.gov/radiation/download-marssim-manual-and-resources>

QAPP Worksheet #19 & 30: Sample Containers, Preservation, and Hold Times

Matrix	Analytical Group	Analytical and Preparation Method/SOP Reference ¹	Containers (number, size, and type)	Sample Volume	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/analysis)	Data Package Turnaround Time
Clean fill (Soil)	PFAS	EPA 537.1 modified	1 x 4-oz. HDPE Jar	4 oz.	Soil, Ice to 6°C	14/40 days	21 days preliminary data 42 days validated data
Aqueous (RB)	PFAS	EPA 537.1 modified	2 x 250ml HPDE	2 x 250 ml	Ice to 6°C preserve with Trizma	14/28 days	21 days preliminary data 42 days validated data
Soil	Gamma Spectrometry	EPA 901.1 / ST-RD-0102	1 x 16oz. plastic or glass	400g	None	None	21 days preliminary data 42 days validated data
	Alpha Spectroscopy	HASL 300 A-01-R / ST-RD-0210	Included with Gamma spec	2g	None	None	21 days preliminary data 42 days validated data
Air	Alpha/Beta Count	Ludlum-3030	RADēCO (0750-37) glass fiber air filter	2,400 cf	None	None	Not Applicable
Wipe	Alpha/Beta Count	Ludlum-3030	Ghost Wipe	100 cm ²	None	None	Not Applicable

¹The website for EPA's ERT/SERAS SOPs is: https://response.epa.gov/site/site_profile.aspx?site_id=2107

² The minimum sample size is based on analysis allowing for sufficient sample for reanalysis. Additional volume is needed for the laboratory Matrix Spike/Matrix Spike Duplicate analyses.

* No sample preservation is required, but sample containers should be completely filled and tightly sealed to preserve sample integrity.

³Laboratory will provide preserved container for aqueous (RB) PFAS Analysis

QAPP Worksheet #20: Field Quality Control Sample Summary

Matrix	Analytical Group	No. of Field Samples	No. of Field Duplicates	No. of Extra Volume Laboratory QC (e.g., MS/MSD) Samples	No. of Field Blanks	No. of Equip. Blanks	No. of Trip. Blanks	No of others	Total No. of Samples to Lab
Clean Fill	PFAS	Up to 2	1	1	NR	1	NR	NR	Up to 4
Soil	Gamma spectrometry, Alpha Spectrometry	Up to 19	1	1	NR	NR	NR	NR	Up to 20
Air	Alpha/Beta Count	Up to 10	NR	NR	NR	NR	NR	NR	Up to 10
Wipe	Alpha/Beta Count	Up to 30	NR	NR	NR	NR	NR	NR	Up to 30

NR – Not Required

QAPP Worksheet #21A: Project Sampling SOP References

Reference Number	Title, Revision Date and/or Number	Originating Organization	SOP Option or Equipment Type (if SOP provides different options)	Modified for Project Work? (Y/N)	Comment
SOP # 2001	General Field Sampling Guidelines; Rev. 1.0, June 2013	EPA's ERT/SERAS	Site-Specific	N	NA
SOP # 2011	Chip, Wipe and Sweep Sampling, Rev 1.1, June 2017	EPA's ERT/SERAS	10x10 sample template, Ghost wipes	N	NA
SOP # 2012	Soil Sampling; Rev.01, July 2001	EPA's ERT/SERAS	Disposable scoops, re-sealable plastic bags, sample jars, laboratory-procured sample containers	N	Adhere to PFAS sampling checklist and protocols
SOP # 2067	Operation of Dataram 4 Particulate Monitor, Rev.0.1, 04/29/20	EPA's ERT	Aerosol Monitor	N	Not applicable
SOP # 2130	Operation of the DryCal Defender Series Primary Flow Calibrator, Rev. 1.0, 01/31/2020	EPA's ERT	Calibrator	N	Not applicable

See Attachment B for EPA's ERT/SERAS SOP #s 2001, 2011, 2012, 2067, and 2130.

https://response.epa.gov/site/site_profile.aspx?site_id=2107

NA – Not applicable

QAPP Worksheet #22: Field Equipment Calibration, Maintenance, Testing, and Inspection

Field Equipment	Calibration Activity	Maintenance Activity	Testing/ Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
Trimble® GeoXT™ handheld GPS	Factory-calibrated by Manufacturer	Charge battery when low	Confirm optimum satellite reception and battery status	Charge battery at least daily	For data accuracy, the unit should receive communication from at least 5 satellites	Charge battery when low or replace battery if it does not hold charge	EPA Equipment office	Not applicable
*Ludlum Model 2241 with 3x3 Gamma Scintillator and shielding	Factory-calibrated by Manufacturer	Replace battery when low	Turn on instrument to confirm sensitivity	As needed	Instrument reads background	EPA Equipment office	EPA Equipment office	Not applicable

*Equipment provided, calibrated, maintained, tested, and inspected by EPA as per WS#9 include Dataram and RADēCO

QAPP Worksheet #23: Analytical SOPs

Reference Number	Title, Revision Date, and/or Number and URL (if available)	Definitive or Screening Data	Analytical Group	Instrument	Modified for Project Work? (Y/N)*
EPA Method 537.1 Modified	Analysis of Per- and Polyfluorinated Alkyl Acids in Water by LC/MS/MS, Rev 1.0/Method 537.1: Determination of Selected Per- and Polyfluorinated Alkyl Substances in Drink Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS)*	Definitive	PFAS	LC-MS/MS	Y
NYSDEC PART 375 Remedial Programs	Sampling, analysis on assessment of per- And polyfluoroalkyl substances (PFAS) October 2020.	Definitive	PFAS	LC-MS/MS	N
AP-011 AP-018	Gamma Spectroscopy Operation, Rev-20, 5/31/17 Operation of the Alpha Spectroscopy Systems Rev-19, 5/31/17	Definitive	Radiochemistry - Gamma Spectroscopy	Canberra	N
AP-002 & AP-005	Sample Preparation Rev21, 10/29/16 & Alpha Isotopic Analyses, Rev-20, 10/31/16	Definitive	Radiochemistry - Alpha Spectroscopy	Canberra	N

LC/MS/MS – Liquid Chromatography/Tandem Mass Spectrometry

*The minimum method-achievable Reporting Limits should be less than or equal to: 0.5 µg/kg (ppb)

QAPP Worksheet #24: Analytical Instrument Calibration

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
LC-MS-MS	See method 537.1 modified	See method 537.1 modified The initial calibration should contain a minimum of five standards for linear fit and six standards for a quadratic fit. The relative standard deviation (RSD) for a quadratic fit calibration should be less than 20%. Linear fit calibration curves should have an R2 value greater than 0.990. The low-level calibration standard should be within 50% - 150% of the true value, and the mid-level calibration standard within 70% - 130% of the true value.*	See method 537.1 modified	See method 537.1 modified	See method 537.1 modified	See method 537.1 modified

- Also see, *Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS)* protocol stipulated in NYSDEC's Part 375 Remedial Program, October 2020

QAPP Worksheet #24: Analytical Instrument Calibration (Continued)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
Gamma Spectrometer	Initial Calibration Verification (ICAL) for Energy, Efficiency, and FWHM peak resolution	Prior to initial use, following repair or loss of control and upon incorporation of new or changed instrument settings	Peak energy difference is within 0.1 keV of reference energy for all points. Peak FWHM < 2.5 keV at 1332 keV. Energy vs channel slope equation shall be linear and accurate to 0.5 keV	Correct problem, then repeat ICAL.	Lab Manager / Analyst	ST-RD-0102
Gamma Spectrometer	Initial Calibration Verification (ICV)	After ICAL for energy/efficiency and prior to analysis of samples.	Observed peaks of second source standard fall within $\pm 10\%$ of initial calibration value relative to the true value.	Verify second source standard and repeat ICV to check for errors. If that fails, identify and correct problem and repeat ICV or ICAL and ICV as appropriate.	Lab Manager / Analyst	ST-RD-0102
Gamma Spectrometer	Continuing Calibration Verification (CCV) (Daily Check)	Daily or prior to use. When working with long count times or batch sequences that run more than a day, CCV is performed at the beginning and end of each analytical batch as long as it not longer than a week.	Energy: ± 0.5 keV at 60 keV; $\pm .75$ keV at 1332 keV. FW HM: $\pm 1.2x$ at 60 keV; $\pm 1.8x$ at 662 keV; $\pm 2.3x$ at 1332 keV. Activity Difference: %difference between the source activity and the reported activity $\pm 5\%$	Correct problem, rerun CCV. If that fails, then repeat ICAL. Reanalyze all samples since the last successful calibration verification.	Lab Manager / Analyst	ST-RD-0102
Gamma Spectrometer	Background Subtraction Count Measurement (BSC) (Long count for subtracting background from blanks or test sources)	Immediately after ICAL and then performed on at least a monthly basis.	Background count rate of the entire spectrum with $\pm 3\sigma$ of the average.	Recount and check control chart for trends. Determine cause, correct problem, re-establish BSC. If background activity has changed, re-establish BSC and reanalyze or qualify all impacted samples since last acceptable BSC.	Lab Manager / Analyst	ST-RD-0102

QAPP Worksheet #24: Analytical Instrument Calibration (Continued)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
Gamma Spectrometer	Instrument Contamination Check (ICC) (Short count for controlling gross contamination)	Daily or when working with long count times before and after each analytical batch. Check after counting high activity samples.	No extraneous peaks identified (i.e., no new peaks in the short background spectrum compared to previous spectra); Background count rate of the entire spectrum with $\pm 3\sigma$ of the average.	Recount the background. If still out of control, locate and correct problem; reanalyze or qualify all impacted samples since last acceptable ICC. If background activity has changed, re-establish BSC and reanalyze samples.	Lab Manager / Analyst	ST-RD-0102
Alpha Spectrometer	Initial Calibration (ICAL) (Energy, efficiency and FWHM peak resolution)	Prior to initial use, following repair or loss of control and upon incorporation of new or changed instrument settings.	3 isotopes within energy range of 3-6 MeV. Energy vs. channel slope equation < 15 keV per channel. Full Width –Half Maximum (FWHM) < 100 keV for each peak used for calibration. Minimum of 3,000 net counts in each peak.	Correct problem, then repeat ICAL.	Lab Manager / Analyst	ST-RD-0210
Alpha Spectrometer	Initial Calibration Verification (ICV)	After initial calibration.	FWHM ≤ 100 keV ; Each peak within ± 40 keV of corresponding calibration peaks in initial energy calibration. Minimum 2000 net counts. Efficiency within 95% - 105% of initial calibration value.	Repeat ICV to check for error. If that fails, identify and correct problem and repeat ICV or ICAL and ICV, as appropriate.	Lab Manager / Analyst	ST-RD-0210
Alpha Spectrometer	Continuing Calibration Verification (CCV) (Pulser check)	Pulser verification daily, prior to analysis of samples.	Observed peak centroid falls ≤ 20 keV from reference energy.	Recount and check control chart for trends. Determine cause, correct problem, and repeat CCV and all associated samples since last successful CCV.	Lab Manager / Analyst	ST-RD-0210

QAPP Worksheet #24: Analytical Instrument Calibration (Continued)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
Alpha Spectrometer	Continuing Calibration Verification (CCV) (Check source)	Weekly source check verification prior to analysis of samples.	FWHM ≤ 100 keV; Each peak within ± 40 keV of corresponding calibration peaks in initial energy calibration. Minimum 2000 net counts. Efficiency within 95% - 105% of initial calibration value.	Recount and check control chart for trends. Determine cause, correct problem, and repeat CCV and all associated samples since last successful CCV.	Lab Manager / Analyst	ST-RD-0210
Alpha Spectrometer	Background Subtraction Count (BSC) Measurement	Prior to initial use or after initial calibration and monthly.	Use a statistical test to determine a change in the background count rate value.	Check control chart for trends and recount. Determine cause, correct problem, re-establish BSC. If background activity has changed, re-establish BSC and reanalyze all impacted samples since last acceptable BSC.	Lab Manager / Analyst	ST-RD-0210
Alpha Spectrometer	Instrument Contamination Check (ICC)	Performed weekly, at minimum, and after counting high activity samples.	Within $\pm 3\sigma$ of mean activity of recent BSC's (minimum of 3 BSCs)	Check control chart for trends and recount. Determine cause and correct problem. Background activity has changed, re-establish BSC and reanalyze all infected samples.	Lab Manager / Analyst	ST-RD-0210

QAPP Worksheet #25: Analytical Instrument and Equipment Maintenance, Testing, and Inspection

Instrument/ Equipment	Maintenance Activity	Testing/Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person for CA	SOP Reference ¹
Tandem Mass Spectrometer	See method 537.1	See method 537.1	See method 537.1	See method 537.1	See method 537.1	See method 537.1	See method 537.1 modified
Gamma Spectrometer	1. Clean cave; fill dewar with N2	1. Physical check	1. Physical check	1. Weekly	1. Acceptable background	Recalibrate	TestAmerica Analyst
Gamma Spectrometer	2. QA check	2. Background and source check	2. Check deviation	2. Daily	2. Within 3 sigma of measured population	Instrument maintenance and consult with Technical director	TestAmerica Analyst
Alpha Spectrometer	1. Clean planchette holders	1. Physical check	1. Physical check	1. Monthly	1. Acceptable background and calibration efficiencies	Recalibrate	TestAmerica Analyst
Alpha Spectrometer	2. Pulser check and background checks	2. Background and source check	2. Check deviation	2. Daily	2. Pulser energy, centroid peak, resolution area peak, calibration and background must pass statistical boundary out-of-range test.	Instrument maintenance and consult with Technical director	TestAmerica Analyst

QAPP Worksheet #26 & 27: Sample Handling, Custody, and Disposal

Sampling Organization: Weston Solutions, Inc., START V

Laboratories: TestAmerica (West Sacramento) Laboratory, 880 Riverside Pkwy, West Sacramento, CA 95605 (PFAS)

Eurofins TestAmerica St. Louis, 13715 Rider Trail North, MO 63045-1205 (Radiochemistry)

Method of sample delivery (shipper/carrier): FedEx

Number of days from reporting until sample disposal: 60 days

Activity	Organization and Title or Position of Person Responsible for the Activity	SOP Reference ¹
Sample Labeling	START V Site Project Manager, START V Sampling Team	EPA-540-R-014-013, October 2014
Chain-of-Custody Form Completion	START V Site Project Manager, START V Sampling Team	EPA-540-R-014-013, October 2014
Sample Packaging	START V Site Project Manager, START V Sampling Team	EPA-540-R-014-013, October 2014
Shipping Coordination	START V Site Project Manager, START V Sampling Team	EPA-540-R-014-013, October 2014
Sample Receipt, Inspection, & Log-in	Laboratory Sample Custodian	EPA-540-R-014-013, October 2014, Non- CLP Laboratories
Sample Custody and Storage	Laboratory Sample Custodian /Laboratory Analytical Personnel	EPA-540-R-014-013, October 2014, Non- CLP Laboratories
Sample Disposal	Field Personnel/Laboratory Sample Custodian /Laboratory Analytical Personnel	EPA-540-R-014-013, October 2014, Non- CLP Laboratories

Sample Identification Procedures: Each sample collected by START V will be designated by a code that will identify the sample in accordance with previous sampling (if applicable). An alpha-numeric code that identifies the site-specific property number will begin the sample nomenclature, followed by media type and location. Duplicate samples will be identified in the same manner as other samples and will be distinguished and documented in the field logbook.

Example Sample Naming Nomenclature for clean fill: CF01-GRAB01-102620-01

CF01- Clean fill Facility Identification Number; GRAB01- Grab Sample Location 01; 102620 - Sample Date;

01- First Sample; Field Duplicate will be identified in the same manner, but will be the next sequential sample number (02)

Example Sample Naming Nomenclature for Post-Excavation Soil Sample: 738UMR-PES01-0012-01

738UMR- Site Identification Number; PES01- Post-Excavation Soil Sample Location 01; 0012- Sample Depth at 0 to 12 inches bgs

01- First Sample; Field Duplicate will be identified in the same manner, but will be the next sequential sample number (02)

.QAPP Worksheet #26 & 27: Sample Handling, Custody, and Disposal (Concluded)

Field Sample Custody Procedures (sample collection, packaging, shipment, and delivery to laboratory): Each sample will be individually identified and labeled after collection, then sealed with custody seals and enclosed in a plastic cooler. The sample information will be COC forms, and the samples shipped to the appropriate laboratory via overnight delivery service or courier. Chain-of-custody records must be prepared in Scribe to accompany samples from the time of collection and throughout the shipping process. Each individual in possession of the samples must sign and date the sample COC Record. The chain-of-custody record will be considered completed upon receipt at the laboratory. A traffic report and chain-of-custody record will be maintained from the time the sample is taken to its final deposition. Every transfer of custody must be noted and signed for, and a copy of this record kept by each individual who has signed. When samples are not under direct control of the individual responsible for them, they must be stored in a locked container sealed with a custody seal. Specific information regarding custody of the samples projected to be collected on the weekend will be noted in the field logbook. The chain-of-custody record should include (at minimum) the following: 1) Sample identification number; 2) Sample information; 3) Sample location; 4) Sample date; 5) Sample Time; 6) Sample Type Matrix; 7) Sample Container Type; 8) Sample Analysis Requested; 9) Name(s) and signature(s) of sampler(s); and 10) Signature(s) of any individual(s) with custody of samples.

A separate chain-of-custody form must accompany each cooler for each daily shipment. The chain-of-custody form must address all samples in that cooler, but not address samples in any other cooler. This practice maintains the chain-of-custody for all samples in case of mis-shipment.

Laboratory Sample Custody Procedures (receipt of samples, archiving, and disposal): A sample custodian at the laboratory will accept custody of the shipped samples, and check them for discrepancies, proper preservation, integrity, etc. If noted, issues will be forwarded to the laboratory manager for corrective action. The sample custodian will relinquish custody to the appropriate department for analysis. At this time, no samples will be archived at the laboratory. Disposal of the samples will occur only after analyses and QA/QC checks are completed.

¹Note: Refer to Contract Laboratory Program Guidance for Field Samplers, EPA-540-R-014-013, October 2014 at:
https://www.epa.gov/sites/production/files/2015-03/documents/samplers_guide.pdf

QAPP Worksheet #28: Analytical Quality Control and Corrective Action
Worksheet # 28A: PFAS– Organics/EPA 537.1 modified (Non-CLP Worksheet)

Matrix	Soil
Analytical Group	PFAS
Concentration Level	Low (ug/kg)
Sampling SOP(s)	EPA/ERT 2001, 2012
Analytical Method/SOP Reference	EPA 537.1 modified, LC/MS/MS
Sampler's Name	Sean Quinn
Field Sampling Organization	Weston Solutions, Inc.
Analytical Organization	TestAmerica (West Sacramento) Laboratory
No. of Sample Locations	3

REQUIREMENT	SPECIFICATION AND FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION
Initial Demonstration of Low System Background	Analyze LRB prior to any other IDC steps	Demonstrate that all method analytes are below 1/3 the MRL and that possible interferences from extraction media do not prevent the identification and quantification of method analytes.	Correct problem and then repeat requirement.
Initial Demonstration of Precision (IDP)	Analyze for to seven replicate LFBs fortified near the midrange calibration concentration	% RSD must be <20%	Correct problem and then repeat requirement.
Initial Demonstration of Accuracy (IDA)	Calculate average recovery for replicates used in IDP.	Mean recovery +/- 30% of true value	Correct problem and then repeat requirement.
Initial Demonstration of Peak Asymmetry Factor	Calculate the peak asymmetry factor using the equation in Section 9.3.9 for the first two eluting chromatographic peaks in a mid-level CAL standard.	Peak asymmetry factor 0.8-1.5	LC conditions require adjustment. Correct problem and then repeat requirement.
Minimum Reporting Limit (MRL) Confirmation	Fortify, extract and analyze seven replicate LFBs at the proposed MRL concentration. Calculate the Mean and the Half Range (HR). Confirm that the upper and lower limits for the Prediction Interval of Result (Upper PIR, and Lower PIR, Sect. 9.2.5.2) meet the recovery criteria.	Upper PIR \leq 150% / Lower PIR \geq 50%	If upper and lower PIR are outside the established range for any analyte the MRL is required to be tested at higher concentration until measured within range.
Quality Control Sample (QCS)	Analyze a standard from a second source, as part of IDC.	Results must be within 70-130% of true value	Correct problem and then repeat requirement or qualify data
Detection Limit (DL) Determination (optional)	Over a period of three days, prepare a minimum of seven replicate LFBs fortified at a concentration estimated to be near the DL. Analyze the replicates through all steps of the analysis. Calculate the DL using the equation in Sect. 9.2.7.1.	Data from DL replicates are not required to meet method precision and accuracy criteria. If the DL replicates are fortified at a low enough concentration, it is likely that they will not meet precision and accuracy criteria.	-

QAPP Worksheet #28: Analytical Quality Control and Corrective Action (Continued)
Worksheet # 28A: PFAS– Organics/EPA 537.1 modified (Non-CLP Worksheet) - Continued

Matrix	Soil
Analytical Group	PFAS
Concentration Level	Low (ug/kg)
Sampling SOP(s)	EPA/ERT 2001, 2012
Analytical Method/SOP Reference	EPA 537.1 modified, LC/MS/MS
Sampler's Name	Sean Quinn
Field Sampling Organization	Weston Solutions, Inc.
Analytical Organization	TestAmerica (West Sacramento) Laboratory
No. of Sample Locations	3

REQUIREMENT	SPECIFICATION AND FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION
Sample Holding Time	14 days with appropriate preservation and storage as described in Sections 8.1-8.5.	Sample results are valid only if samples are extracted within the sample holding time.	Recollect Samples
Extract Holding Time	28 days when stored at room temperature in polypropylene centrifuge tubes.	Extract results are valid only if extracts are analyzed within the extract holding time.	Re-extract Samples

Laboratory Reagent Blank (LRB)	Daily, or with each extraction batch of up to 20 samples, whichever is more frequent.	Demonstrate that all method analytes are below 1/3 the MRL, and confirm that possible interferences do not prevent quantification of method analytes. If targets exceed 1/3 the MRL or if interferences are present, results for these subject analytes in the extraction batch are invalid.	Correct problem. If require, reprepare and reanalyze MB and all samples processed with the contaminated blank and/or qualify affected analytes as estimated (J).
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Laboratory Fortified Blank (LFB)	Analyze at least one LFB daily or one for each extraction batch of up to 20 Field Samples. Rotate the fortified concentrations between low, medium, and high amounts.	Results of LFB analyses must be 70-130% of the true value for each method analyte for all fortified concentrations except the lowest CAL point. Results of the LFBs corresponding to the lowest CAL point for each method analyte must be 50-150% of the true value.	Correct problem, then reprepare and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available and /or – if native compounds present recoveries below <50%, qualify the affected analytes (including non-detects) as biased low (L). If average recoveries >150% qualify hits as biased high (K). If %RSD>35 qualify hits as estimated (J).
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QAPP Worksheet #28: Analytical Quality Control and Corrective Action (Continued)
Worksheet # 28A: PFAS– Organics/ EPA 537.1 modified (Non-CLP Worksheet) - Continued

Matrix	Soil
Analytical Group	PFAS
Concentration Level	Low (ug/kg)
Sampling SOP(s)	EPA/ERT 2001, 2012
Analytical Method/SOP Reference	EPA 537.1 modified, LC/MS/MS
Sampler's Name	Sean Quinn
Field Sampling Organization	Weston Solutions, Inc.
Analytical Organization	TestAmerica (West Sacramento) Laboratory
No. of Sample Locations	3

REQUIREMENT	SPECIFICATION AND FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION
Internal Standard (IS)	Internal standards, 13 C-PFOA (IS#1), 13CPFOS (IS#2), and d3-NMeFOSAA (IS#3), are added to all standards and sample extracts, including QC samples. Compare IS areas to the average IS area in the initial calibration and to the most recent CCC.	Peak area counts for all IS in all injections must be within +/- 50% of the average peak area calculated during the initial calibration and 70-140% from the most recent CCC. If IS do not meet this criterion, corresponding target results are invalid.	If recoveries are outside the acceptable range prepare a second vial using the backup aliquot. If the reinjected aliquot produces an acceptable IS response, the result can be reported and/or qualify the affected analytes as estimated (J).

Surrogate Standard (SUR)	Surrogate standards, 12C-PFHxA, 13C-PFDA, and d5-NEtFOSAA, are added to all CAL standards and samples, including QC samples. Calculate SUR recoveries.	SUR recoveries must be 70-130% of the true value. If a SUR fails this criteria, report all results for sample as suspect/SUR recovery.	If recoveries are outside the acceptable range correct the problem and reanalyze the extract. If the reinjected aliquot produces and acceptable ES response, the result can be reported. If the reinjected extract fails again, calibration must be checked by reanalyzing the most recently acceptable CCV standard and/or qualify affected samples as estimated (J).
Laboratory Fortified Sample Matrix (LFSM)	Analyze one LFSM per extraction batch (20 samples or less) fortified with method analytes at a concentration close to but greater than the native concentration, if known. Calculate LFSM recoveries.	Recoveries at mid and high levels should be within 70-130% and within 50-150% at the low-level fortified amount (near the MRL). If these criteria are not met, results are labeled suspect due to matrix effects.	If MS results are outside the limits, the data shall be evaluated to determine the source(s) of difference, i.e., matrix effect or analytical error. If the analyte is within control in the CCVs, the recovery is judged to be matrix biased and affected sample is qualified.

QAPP Worksheet #28: Analytical Quality Control and Corrective Action (Continued)
Worksheet # 28A: PFAS– Organics/ EPA 537.1 modified (Non-CLP Worksheet) – Concluded)

Matrix	Soil
Analytical Group	PFAS
Concentration Level	Low (ug/kg)
Sampling SOP(s)	EPA/ERT 2001, 2012
Analytical Method/SOP Reference	EPA 537.1 modified, LC/MS/MS
Sampler's Name	Sean Quinn
Field Sampling Organization	Weston Solutions, Inc.
Analytical Organization	TestAmerica (West Sacramento) Laboratory
No. of Sample Locations	3

REQUIREMENT	SPECIFICATION AND FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION
Laboratory Fortified Sample Matrix Duplicate (LFSMD) or Field Duplicates (FD)	Extract and analyze at least one FD or LFSMD with each extraction batch (20 samples or less). A LFSMD may be substituted for a FD when the frequency of detects are low. Calculate RPDs.	Method analytes RPDs for the LFMD or FD should be $\leq 30\%$ at mid and high levels of fortification and $\leq 50\%$ near the MRL. If these criteria are not met, results are labeled suspect due to matrix effects.	If MSD/MD results are outside the limits, the data shall be evaluated to determine the source(s) of error, i.e. matrix effect or analytical error. If the analyte is within control in the CCVs, the recovery is judged to be matrix biased and sample qualified with a J to indicate and estimated value(s).

Field Reagent Blank (FRB)	Analysis of the FRB is required only if a Field Sample contains a method analyte or analytes at or above the MRL. The FRB is processed, extracted and analyzed in exactly the same manner as a Field Sample.	If the method analyte(s) found in the Field Sample is present in the FRB at a concentration greater than 1/3 the MRL, then all samples collected with that FRB are invalid and must be recollected and reanalyzed.	If the method analyte(s) found in the FS is present in the FB at concentration greater than 1/3 the MRL, then all samples collected with that FB are invalid and must be recollected and reanalyzed and/or results qualified as estimated (J).
Peak Asymmetry Factor	Calculate the peak asymmetry factor for the first two eluting chromatographic peaks in a mid-level CAL standard every time a calibration curve is generated.	Peak asymmetry factor 0.8-1.5	LC conditions require adjustment.
Quality Control Sample (QCS)	Analyze at least quarterly or when preparing new standards, as well as during the IDC.	Results must be within 70-130% of true value.	Correct problem, then reprepare and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available and/or qualify as estimated (J).

QAPP Worksheet #28: Analytical Quality Control and Corrective Action (Continued)
QAPP Worksheet #28B: Radiochemistry - Gamma Spectrometry (non-CLP Worksheet)

Matrix		Soil				
Analytical Group		Gamma Spectrometry				
Concentration Level		Medium (pCi/g)				
Sampling SOP(s)		EPA/ERT 2001, 2012				
Analytical Method/SOP Reference		EPA Method 901.1				
Sampler's Name		Sean Quinn				
Field Sampling Organization		Weston Solutions, Inc.				
Analytical Organization		Eurofins TestAmerica St. Louis				
No. of Sample Locations		20				
QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	One per preparation batch	No target analytes detected > target detection limit	Correct problem. If required, re-prepare and reanalyze MB and all samples processed with the contaminated blank.	Analyst, Supervisor	Accuracy/Bias/Contamination	No target analytes detected > target detection limit
LCS	One per preparation batch	Recovery limits: 87-120% for Cs-137, 87-115% for Co-60, 87-116% for Am-241	Correct problem, then re-prepare and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available.	Analyst, Supervisor	Accuracy/Bias	Target analytes must be within recovery limits
Duplicate	One per preparation batch	RPD limit of 40% or DER < 3	Correct problem, then re-prepare and reanalyze all samples in the associated preparatory batch, if not excursion not caused by sample matrix.	Analyst, Supervisor	Precision/Accuracy/Bias	The absolute value of the sample analyte result minus the duplicate analyte result divided by the square root of the sum of the squares of the sample and duplicate one-sigma analyte uncertainties must be less than 3.0

QAPP Worksheet #28: Analytical Quality Control and Corrective Action (Continued)
Worksheet #28C: Radiochemistry - Alpha Spectroscopy (non-CLP Worksheet)

Matrix		Soil				
Analytical Group		Alpha Spectroscopy				
Concentration Level		Medium (pCi/g)				
Sampling SOP(s)		EPA/ERT 2001, 2012				
Analytical Method/SOP Reference		HASL-300/A-01-R				
Sampler's Name		Sean Quinn				
Field Sampling Organization		Weston Solutions, Inc.				
Analytical Organization		Eurofins TestAmerica St. Louis				
No. of Sample Locations		20				
QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	One per preparation batch	No analytes detected > target detection limit	Correct problem. If required, re-prepare and reanalyze MB and all samples processed with the contaminated blank.	Analyst, Supervisor	Accuracy/Bias/Contamination	No target analytes detected > target detection limit
LCS	One per preparation batch	Recovery limits: 84-120% for U-234 and 82-122% for U-238 Recovery limits: 81-118% for Th-230	Correct problem, then re-prepare and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available.	Analyst, Supervisor	Accuracy/Bias	Target analytes must be within recovery limits
Duplicate	One per preparation batch	RPD limit of 40% or DER < 3	Correct problem, then re-prepare and reanalyze all samples in the associated preparatory batch, if not excursion not caused by sample matrix.	Analyst, Supervisor	Precision/Accuracy/Bias	The absolute value of the sample analyte result minus the duplicate analyte result divided by the square root of the sum of the squares of the sample and duplicate one-sigma analyte uncertainties must be less than 3.0

QAPP Worksheet #28: Analytical Quality Control and Corrective Action (Concluded)
Worksheet #28C: Radiochemistry - Alpha Spectroscopy (non-CLP Worksheet), Concluded

Matrix		Soil				
Analytical Group		Alpha Spectroscopy				
Concentration Level		Medium (pCi/g)				
Sampling SOP(s)		EPA/ERT 2001, 2012				
Analytical Method/SOP Reference		HASL-300/A-01-R				
Sampler's Name		Sean Quinn				
Field Sampling Organization		Weston Solutions, Inc.				
Analytical Organization		Eurofins TestAmerica St. Louis				
No. of Sample Locations		20				
QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective	Data Quality Indicator (DQI)	Measurement Performance Criteria
Tracer (U-232 and Th-229)	Every Sample	Recovery limits of 30-110%	Truncate tracers above 100% recovery to eliminate low biased results. Reprep and reanalyze sample if carrier is low (indicating high biased results) if there is activity in the sample above the reporting limit. No reanalysis if matrix interference is noticed during sample preparation.	Analyst, Supervisor	Accuracy/Bias	Tracer yield within recovery limits

QAPP Worksheet #29: Project Documents and Records

Sample Collection and Field Records			
Record	Generation	Verification	Storage Location/Archival
Field Logbook or Data Collection Sheets	SPM/Field Personnel	Group Leader or Operations Manager	Project File
Chain-of-Custody Forms	SPM/Field Personnel	Group Leader or Operations Manager	Project File
Custody Seals	SPM/Field Personnel	Group Leader or Operations Manager	Project File
Air Bills	SPM/Field Personnel	Group Leader or Operations Manager	Project File
Daily QC Reports	SPM	Group Leader or Operations Manager	Project File
Deviations	SPM/Field Scientist	Group Leader or Operations Manager	Project File
Corrective Action Reports	Delegated QA Manager	Operations Manager or Program Manager or designee	Project File
Correspondence	SPM	Delegated QA Manager	Project File
Field Sample Results/Measurements	SPM/Field Scientist	Delegated QA Manager	Project File
Tailgate Safety Meeting Items	SPM/Field Safety Officer	Delegated QA Manager	Project File

Project Assessments			
Record	Generation	Verification	Storage Location/Archival
Data Verification Checklists	Data validator/Chemist QA/QC Specialist	Group Leader or Operations Manager	Project File
Data Validation Report	Data validator/Chemist QA/QC Specialist	Group Leader or Operations Manager	Project File
Data Usability Assessment Report	Site Project Manager	Group Leader or Operations Manager	Project File
Corrective Action Reports	Group Leader/HSO/Chemist QA/QC Specialist	Group Leader	Project File
Correspondence	Group Leader/HSO/Chemist QA/QC Specialist	Program Manager or designee	Project File

QAPP Worksheet #29: Project Documents and Records (Concluded)

Laboratory Records			
Record	Generation	Verification	Storage Location/Archival
Sample Receipt, Custody, and Checklist	Laboratory Sample Receiving	Laboratory PM/Delegated QA Manager	Laboratory Data Package and Project File
Equipment Calibration Logs	Laboratory Technician	Laboratory PM/Delegated QA Manager	Laboratory Data Package and Project File
Standard Traceability Logs	Laboratory Technician	Laboratory PM/Delegated QA Manager	Laboratory Data Package and Project File
Sample Prep Logs	Laboratory Technician	Laboratory PM/Delegated QA Manager	Laboratory Data Package and Project File
Run Logs	Laboratory Technician	Laboratory PM/Delegated QA Manager	Laboratory Data Package and Project File
Equipment Maintenance, Testing, and Inspection Logs	Laboratory Technician/ Laboratory QA Manager	Laboratory PM/Delegated QA Manager	Laboratory File
Corrective Action Reports	Laboratory QA Manager	Laboratory PM/Delegated QA Manager	Laboratory File and Project File
Laboratory Analytical Results	Laboratory Technician/ Laboratory QA Manager	Laboratory PM/Delegated QA Manager	Laboratory Data Package and Project File
Laboratory QC Samples, Standards, and Checks	Laboratory Technician/ Laboratory QA Manager	Laboratory PM/Delegated QA Manager	Laboratory Data Package and Project File
Instrument Results (raw data) for Primary Samples, Standards, QC Checks, and QC Samples	Laboratory Technician/ Laboratory QA Manager	Laboratory PM/Delegated QA Manager	Laboratory Data Package and Project File
Sample Disposal Records	Laboratory Technician	Laboratory PM/Delegated QA Manager	Laboratory File

	Laboratory Data Deliverables ¹						
Record	VOCs	SVOCs	PCBs	Pesticides	Metals	Other ²	Other ³
Narrative	N	N	N	N	N	Y	Y
Chain of Custody	N	N	N	N	N	Y	Y
Summary Results	N	N	N	N	N	Y	Y
QC Results	N	N	N	N	N	Y	Y
Chromatograms or raw data	N	N	N	N	N	Y	Y
Tentatively Identified Compounds	N	N	N	N	N	NA	NA

¹ The blank Laboratory Data Deliverables table is designed to be a checklist for use in supporting data completeness. The records and analytical groups in this table are not all inclusive of those that may be used on a specific project and should be modified and utilized by the delegated SPM as applicable

² PFAS (PFOA and PFOS)

³ Alpha Spectroscopy and Gamma Spectroscopy

Worksheet 31, 32 & 33 — Assessments and Corrective Action

Assessments:

Assessment Type	Responsible Party & Organization	Number/ Frequency	Estimated Dates	Assessment Deliverable	Deliverable Due Date
Field Sampling Technical Systems Audit (TSA) ¹	Chemist QA/QC Specialist (or designee) and Group Leader or Operational Manager WESTON	As needed, as determined by WESTON Chemist QA/QC Specialist (or designee) and Group Leader or Program Manager WESTON	To be completed near the beginning of field sample collection activities/TBD	TSA Memorandum and Checklist	48 to 72 hours following assessment
Laboratory TSA ²	Laboratories QA Managers Regulatory Agency	Non-CLP and certified subcontract laboratories are routinely audited by accrediting authorities.	Every Year	Written Report	14 Days
Data Validation	Chemist QA/QC Specialist or Data Validator WESTON	Each data package for which data validation was requested; varies by site	Within 42 days from sampling date	Data Validation Report	Varies by site
Management Review	Group Leader and/or Operational Manager WESTON	Varies; as determined by WESTON Program Manager	Within 42 days from sampling date	Quality Management Report (memo/e-mail to file)	1-2 weeks following assessment

¹ Field sampling TSAs may include, but are not limited to the following: sample collection records; sample handling, preservation, packaging, shipping, and custody records; equipment operation, maintenance, and calibration records.

² Laboratory TSAs may include, but are not limited to the following: sample log-in, identification, storage, tracking, and custody procedures; sample and standards preparation procedures; availability of analytical instruments; analytical instrument operation, maintenance, and calibration records; laboratory security procedures; qualifications of analysts; case file organization and data handling procedures.

Worksheet 31, 32 & 33 — Assessments and Corrective Action (Concluded)

Assessment Response and Corrective Action:

Assessment Type	Responsibility for Responding to Assessment Findings	Assessment Response Documentation	Timeframe for Response	Responsibility for Implementing Corrective Action	Responsible for Monitoring Corrective Action Implementation
Field Sampling Technical Systems Audit (TSA) ¹	SPM WESTON	Findings of field audit.	24 hours of receipt of audit report	Operational Manager WESTON	SPM or Operational Manager WESTON
Laboratory TSA ²	Laboratories QA Managers: Eurofins TestAmerica St. Louis Laboratory QA manager: Frank Mike TestAmerica (West Sacramento) Laboratory QA manager: Frank Mike Chemist QA/QC Specialist (or designee) WESTON	Written response to EPA Region II to address deficiencies	1 week of receipt of request from EPA Region II (or START V on behalf of EPA)	Non-CLP Laboratory Manager	Quality Manager (or designee) and/or Chemist WESTON
Data Validation	Non-CLP data: Chemist QA/QC Specialist (or designee) WESTON	Validation Report	Within 48 hours of receipt of validation inquiry	Laboratory QA Manager and/or Chemist	Chemist WESTON
Management Review	Program Manager WESTON	Quality Management Response	48 hours of receipt of Quality Management report	Program Manager WESTON	Chemist QA/QC Specialist (or designee) and Program Manager WESTON

¹ Field sampling TSAs may include, but are not limited to the following: sample collection records; sample handling, preservation, packaging, shipping, and custody records; equipment operation, maintenance, and calibration records.

² Laboratory TSAs may include, but are not limited to the following: sample log-in, identification, storage, tracking, and custody procedures; sample and standards preparation procedures; availability of analytical instruments; analytical instrument operation, maintenance, and calibration records; laboratory security procedures; qualifications of analysts; case file organization and data handling procedures.

QAPP Worksheet #34: Data Verification and Validation Inputs

Item	Description	Verification (completeness)	Validation (conformance to specifications)
Planning Documents/Records			
1	Approved QAPP	X	
2	Contract	X	
3	Field SOPs	X	
4	Laboratory SOPs	X	
5	Laboratory QA Manual	NA	
6	Laboratory Certifications	X	
Field Records			
7	Field Logbooks	X	X
8	Equipment Calibration Records	X	X
9	Chain of Custody Forms	X	X
10	Sampling Diagrams/Surveys	X	X
11	Drilling Logs	NA	NA
12	Geophysics Reports	NA	NA
13	Relevant Correspondence	X	X
14	Change Orders/Deviations	X	X
15	Field Audit Reports	X	X
16	Field Corrective Action Reports	X	X
17	Sample Location Verification (Worksheet 18)	X	X
Analytical Data Package and Other Laboratory Deliverables			
18	Cover Sheet (laboratory identifying information)	X	X
19	Case Narrative	X	X
20	Internal Laboratory Chain of Custody	X	X
21	Sample Receipt Records	X	X
22	Sample Chronology (i.e. dates and times of receipt, preparation, & analysis)	X	X
23	Communication Records	X	X
24	Project-specific PT Sample Results	NA	NA
25	RL/MDL Establishment and Verification	X	X
26	Standards Traceability	NA	NA
27	Instrument Calibration Records	X	X
28	Definition of Laboratory Qualifiers	X	X
29	Results Reporting Forms	X	X
30	QC Sample Results	X	X
31	Corrective Action Reports	X	X
32	Raw Data	X	X
33	Electronic Data Deliverable	X	X

QAPP Worksheet #35: Data Verification Procedures

Records Reviewed	Required Documents	Process Description	Responsible Person, Organization
Contract QAPP	Contract, EPA and UFP-QAPP Guidance documents	Verify completeness, correctness, and contractual compliance of all program QA/QC against the methods, SOPs, and contract requirements.	Timothy Benton WESTON Program Manager Smita Sumbaly, WESTON Chemist QA/QC Specialist
Site-specific QAPP	Contract QAPP, Work Scope in TDD	Verify sampling and analytical methods specified in site-specific QAPP are correct and all contract QAPP protocols are followed and required QC samples will be collected in the correct bottles and properly preserved.	Bernard Nwosu WESTON Operational Manager Smita Sumbaly, WESTON Chemist QA/QC Specialist
Field Logs and SOPs	Contract and site-specific QAPP, SOPs	Ensure that all field sampling SOPs specified in site-specific QAPP were followed.	WESTON SPM and Data Validation Personnel
Analytical SOPs	Analytical Method and Contract QAPP	Ensure that laboratory analytical SOPs comply with the published method.	Non-CLP Laboratory/ TestAmerica (West Sacramento) Laboratory QA Manager: Mike Frank Non-CLP Laboratory/ Eurofins TestAmerica St. Louis QA Manager: Frank Mike Smita Sumbaly, WESTON Chemist QA/QC Specialist /Data validation Personnel
Laboratory QA Manual	EPA Guidance Documents	Verify that best practices specified in EPA Guidance Documents are incorporated into the Laboratory QA Manual.	non-CLP Laboratories QA Managers TBD/ TestAmerica (West Sacramento) Laboratory Frank Mike /Eurofins TestAmerica St. Louis
Laboratory Certifications	Generic and site-specific QAPP	Ensure that laboratory performing analytical sample analyses has current State, National Environmental Laboratory Accreditation Program, National Voluntary Laboratory Accreditation Program, or American Industrial Hygiene Association certifications as required by the project.	non-CLP Laboratories QA Manager: Mike Frank TBD/Eurofins TestAmerica St. Louis /Eurofins TestAmerica St. Louis Smita Sumbaly, WESTON Chemist QA/QC Specialist
Laboratory Deliverables	Contract and site-specific QAPP	Verify that the laboratory deliverable contains all records specified in the contract QAPP. Check sample receipt records to ensure sample condition upon receipt was noted, and any missing/broken sample containers were noted and reported. Compare the data package with Chains of custody to verify that results were provided for all collected samples. Review the narrative to ensure all QC exceptions are described. If Stage 2B or higher validation is required, verify that analytical instrumentation met calibration requirements. Check for evidence that any required notifications were provided to project personnel. Verify that necessary signatures and dates are present.	Non-CLP Data: Data Validators, WESTON, Smita Sumbaly, Chemist QA/QC Specialist & subcontracted CHP data validators for radiological parameters

* Site-specific QAPP may contain additional data validation inputs as required by the project objectives.

QAPP Worksheet #35: Data Verification Procedures (Concluded)

Records Reviewed	Required Documents	Process Description	Responsible Person, Organization
WESTON Data Validation Deliverables	Laboratory Report, Analytical Method and Laboratory SOPs	Verify that the report consists of the following for all field samples submitted to the laboratory: 1) Data validation report (pdf), 2) Sample Summary Report with data validation qualifiers, and 3) Excel EDD file with data validation qualifiers	WESTON Data Validator Smita Sumbaly, WESTON Chemist QA/QC Specialist
Field Logbook, Field Sheets, Sample Diagrams/ Surveys	Contract and site-specific QAPP	Verify that records are present and complete for each day of field activities. Verify that all planned samples including field QC samples were collected and that sample collection locations are documented. Verify that meteorological data were provided for each day of field activities. Verify that changes/exceptions are documented and were reported in accordance with requirements. Verify that any required field monitoring was performed and results are documented.	WESTON SPM and Operational Manager
Field Equipment Calibration Records	Contract and site-specific QAPP, SOPs, field logbook	Ensure that all field analytical instrumentation SOPs for equipment calibration were followed.	WESTON SPM and Operational Manager
Chain of Custody Forms	Site-specific QAPP; Field Logbook; and other sampling records (e.g., boring logs, etc.)	Verify the completeness of Chain-of-Custody records. Examine entries for consistency with the field logbook. Check that appropriate methods were requested and sample preservation was recorded. Verify that the required volume of sample has been collected and that sufficient sample volume is available for Laboratory QC samples (e.g., MS/MSD and S/D). Verify that all required signatures and dates are present. Check for transcription errors.	WESTON SPM, WESTON Chemist QA/QC Specialist, and Laboratory PM, Rhonda Ridenhower
Relevant reports and correspondence	Contract and site-specific QAPP	Verify that reports are present and complete for each day of field activities. Verify that correspondence is documented and was reported in accordance with requirements.	WESTON Operational Manager and SPM
Audit Reports, Corrective Action Reports	Generic and site-specific QAPP	Verify that all planned audits were conducted. Examine audit reports. For any deficiencies noted, verify that corrective action was implemented according to plan.	non-CLP Laboratories QA Managers Mike Frank/ TestAmerica (West Sacramento) Laboratory Frank Mike /Eurofins TestAmerica St. Louis Smita Sumbaly, WESTON Chemist QA/QC Specialist Laboratory PM, Rhonda Ridenhower

Worksheet 36 — Data Validation Procedures

The following information is project-specific and will be identified in the site-specific or QAPP.

Data Validator: WESTON

Analytical Group/Method	Data Deliverable Requirements	Analytical Specifications	MPC	Percent of Data Packages to be Validated	Percent of Raw Data Reviewed	Percent of Results to be Recalculated	Validation Procedure	Validation Code	Electronic Validation Program/Version
PFAS	SEDD Stage IIa/IIb	EPA 537.1 Modified	Worksheets 12, 24, 28	100%	100%	10%	As per lab SOPs and Analytical Methods	Validated Manually (VM)	Excel EDD
Radiochemistry EPA 901.1/HASL-300-A-01-R	SEDD Stage IIa/IIb	SEDD Stage IIa/IIb	Worksheets 12, 24, 28	100%	100%	10%	As per lab SOPs and Analytical Methods	Validated Manually (VM)	Excel EDD

QAPP Worksheet #37: Usability Assessment

Data usability assessments (DUA) will be performed as directed by EPA. This worksheet documents procedures that will be used to perform the DUA. The DUA is performed at the conclusion of data collection activities using the outputs from data verification and data validation (i.e., data of known and documented quality). It is the data interpretation phase, which involves a qualitative and quantitative evaluation of environmental data to determine whether the Site data are of the right type, quality, and quantity to support the decisions that need to be made. It involves a retrospective evaluation of the systematic planning process, and involves participation by key members of the project team. The DUA evaluates whether underlying assumptions used during systematic planning are supported, sources of uncertainty have been accounted for and are acceptable, data are representative of the population of interest, and the results can be used as intended, with the acceptable level of confidence.

Data, whether generated in the field or by the laboratory, are tabulated and reviewed for PARCCS by the SPM for field data or the data validator for laboratory data. The review of the PARCC Data Quality Indicators (DQI) will compare with the Data Quality Objectives (DQO) detailed in the site-specific QAPP, the analytical methods used and impact of any qualitative and quantitative trends will be examined to determine if bias exists. A hard copy of field data is maintained in a designated field or site logbook. Laboratory data packages are validated, and final data reports are generated. All documents and logbooks are assigned unique and specific control numbers to allow tracking and management.

Where applicable, the following documents will be followed to evaluate data for fitness in decision making: EPA QA/G-4, Guidance on Systematic Planning using the Data Quality Objectives Process, EPA/240/B-06/001, February 2006, and EPA QA/G-9R, Guidance for Data Quality Assessment, A reviewer's Guide EPA/240/B-06/002, February 2006.

Personnel (organization and position/title) responsible for participating in the data usability assessment may include, but not be limited to:

- START V Operations Manager;
- START V Quality Manager (or designee);
- START V Risk Assessor;
- START V SPM;
- START V Chemist QA/QC Specialist;
- START V Statistician.

Based on project-specific oversight responsibilities and analytical scopes, this DUA worksheet outlines the approach that will be taken as the analytical scope expands on a project-specific basis.

The following general steps will be followed to assure that the data usability assessment evaluates whether underlying assumptions used during systematic planning are supported, sources of uncertainty have been accounted for and are acceptable, data are representative of the population of interest, and the results can be used as intended, with the acceptable level of confidence:

QAPP Worksheet #37: Usability Assessment (Concluded)

Step 1 – Review the project’s objectives and sampling design: This includes reviewing the DQOs and MPC to make sure they are still applicable. The sampling design will be consistent with stated DQOs.

Step 2 – Review the data verification and data validation outputs: Graphs, maps, and tables can be prepared to summarize the data. Deviations from activities planned in the Project QAPP should be considered, including samples not collected (potential data gaps), holding time exceedances, damaged samples, impact of non-compliant PE sample results, and SOP deviations. The implications of unacceptable QC sample results will be assessed.

Step 3 – Verify the assumptions of the selected statistical method: The underlying assumptions for the selected statistical methods (if specified in the QAPP) will be verified for validity. Common assumptions include the distributional form of the data, independence of the data, dispersion characteristics, homogeneity, etc. Depending on the robustness of the statistical method, minor deviations from assumptions usually are not critical to statistical analysis and data interpretation. If serious deviations from assumptions are discovered, then another statistical method may be selected.

Step 4 - Implement the statistical method: If specified in the site-specific QAPP, statistical procedures will be implemented for analyzing the data and reviewing underlying assumptions. For a decision project that involves hypothesis testing (e.g., “concentrations of lead in groundwater are below the action level”) the consequences of selecting the incorrect alternative will be considered; for estimation projects (e.g., establishing a boundary for surface soil contamination), the tolerance for uncertainty in measurements will be considered.

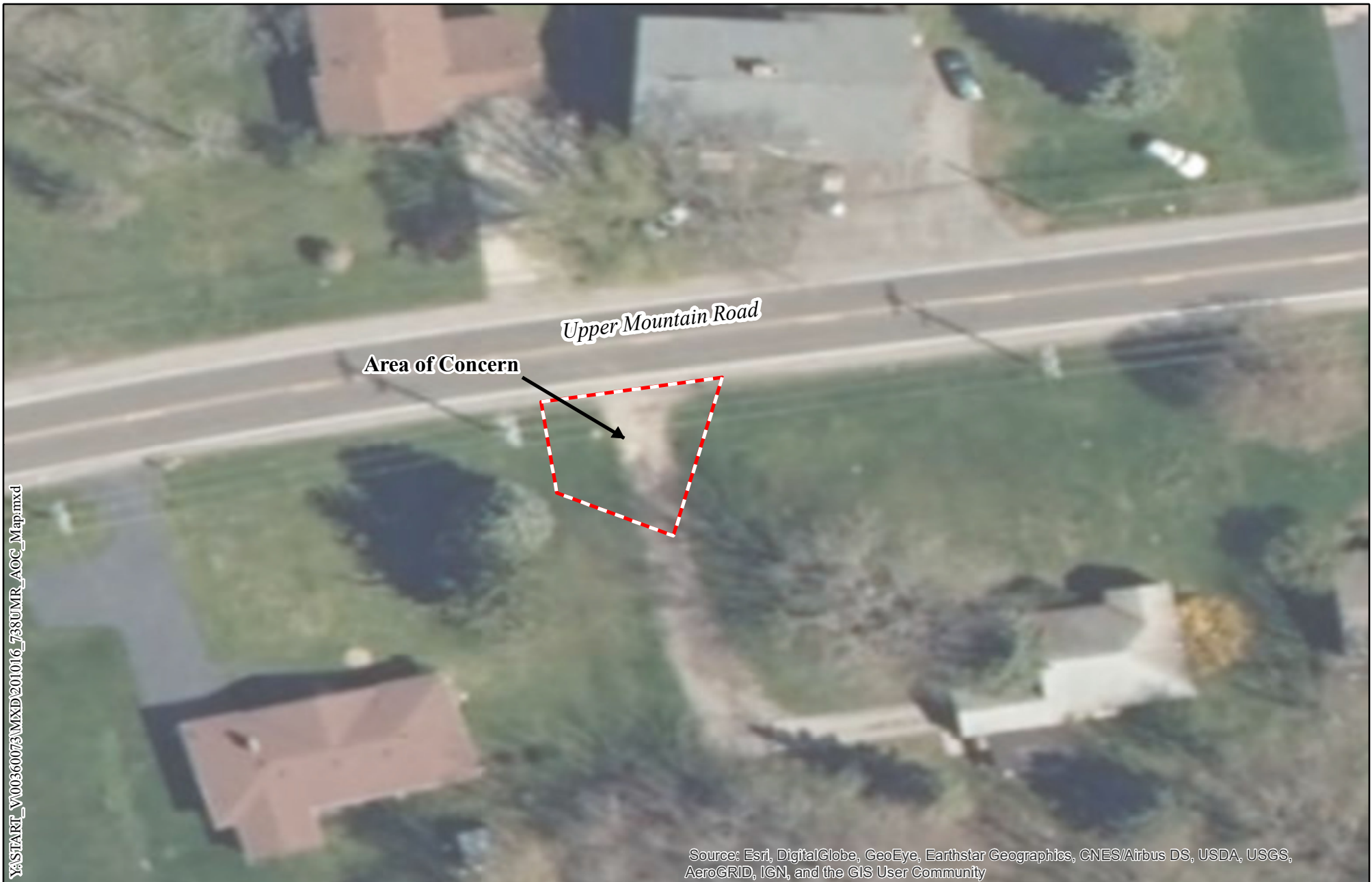
Step 5 – Document data usability and draw conclusions:

The DUA considered the final step in the data evaluation process. All data will be assessed for usability regardless of data evaluation/validation process implementation. Data usability goes beyond validation in that it evaluates the achievement of the DQOs based on the comparison of the project DQIs and site-specific QAPP with the obtained results. The results of the DUA, and particularly any changes to the DQOs necessitated by the data not meeting usability criteria, will be communicated in accordance with Worksheet 6.

The usability of the data as intended will be determined. Achievable DQOs, based on comparison with the Site DQIs, will be discussed. The performance of the sampling design will be assessed and limitations of the data use identified. The conceptual site model will be updated and conclusions documented. A DUA report (in the form of text/or table) will be prepared or a data usability summary will be included in the final report.

ATTACHMENT A


Figure 1: Site Location Map
Figure 2: Area of Concern Map



\\ASTART_V00360073\MXD\201016_738UMR_AOC_Map.mxd

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

 Area of Concern



Weston Solutions, Inc.
Federal East Division

In Association With
Eco-Risk; Avatar Environmental, LLC;
Pro-West & Associates, Inc.;
On-Site Environmental, Inc.;
and Sovereign Consulting, Inc.

Figure 2: Area of Concern Map

738 UPPER MOUNTAIN ROAD
LEWISTON, NEW YORK

U.S. ENVIRONMENTAL PROTECTION AGENCY
SUPERFUND TECHNICAL ASSESSMENT
& RESPONSE TEAM V
CONTRACT # 68HE0319D0004

DATE MODIFIED: 10/19/2020
GIS ANALYST: M. LANG
EPA OSC: P. LISICHENKO
START V SPM: S. QUINN
FILENAME: 201016_738UMR_AOC_Map.mxd

ATTACHMENT B

Sampling SOPs

ERT/SERAS SOP # 2001: General Field Sampling Guidelines

ERT/SERAS SOP # 2011: Chip, Wipe and Sweep Sampling

ERT/SERAS SOP # 2012: Soil Sampling

ERT SOP # 2067: Operation of DataRAM

ERT SOP# 2130: Operation of DryCal DC-Lite

NYSDEC DER-10, Technical Guidance for Site Investigation and Remediation, May 3, 2010

Field Sampling Protocols to Avoid Cross-Contamination at Perfluorinated Chemical Sites
Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS) NYSDEC



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GENERAL FIELD SAMPLING GUIDELINES

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Complete Rewrite: SOP #2001; Revision 1.0; 03/15/13; U.S. EPA Contract EP-W-09-031

SUPERCEDES: SOP #2001; Revision 0.0; 08/11/94; U.S. EPA Contract 68-C4-0022



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GENERAL FIELD SAMPLING GUIDELINES

1.0 OBJECTIVE

The objective of this standard operating procedure (SOP) is to describe the general field sampling techniques and guidelines that will assist the Scientific Engineering Response and Analytical Services (SERAS) personnel in planning, choosing sampling strategies and sampling locations, and frequency of Quality Control (QC) samples for proper assessment of site characteristics. The ultimate goal is to ensure data quality during field collection activities.

2.0 APPLICABILITY

This SOP applies to the collection of aqueous and non-aqueous samples for subsequent laboratory analysis to determine the presence, type, and extent of contamination at a site.

3.0 DESCRIPTION

Representative sampling ensures that a sample or a group of samples accurately reflect the concentration of the contaminant at a given time and location. Depending on the contaminant of concern and matrix, several variables may affect the representativeness of the samples and subsequent measurements. Environmental variability due to non-uniform distribution of the pollutant due to topographic, meteorological and hydrogeological factors, changes in species, and dispersion of contaminants and flow rates contribute to uncertainties in sampling design.

Determining the sampling approach depends on what is known about the site from prior sampling (if any) and the site history, variation of the contaminant concentrations throughout a site, potential migration pathways, and human and environmental receptors. The objectives of an investigation determine the appropriate sampling design.

The frequency of sampling and the specific sample locations that are required must be defined in the site-specific Quality Assurance Project Plan (QAPP).

3.1 Planning Stage

The objectives of an investigation are established and documented in the site-specific QAPP. The technical approach including the media/matrix to be sampled, sampling equipment to be used, sampling design and rationale, and SOPs or descriptions of the procedure to be implemented are included in the QAPP. Refer to the matrix-specific SOPs for sampling techniques which include the equipment required for sampling.

During the planning stage, the data quality objectives (DQOs) will be determined. In turn, the project's DQOs will determine the need for screening data or definitive data. Screening data supports an intermediate or preliminary decision but eventually is supported by definitive data before the project is complete (i.e., placement of monitor wells, estimation of extent of contamination). Definitive data is suitable for final decision making, has defined precision and accuracy requirements and is legally defensible (i.e., risk assessments, site closures).

3.2. Sampling Design

Representative sampling approaches include judgmental, random, systematic grid, systematic simple random, stratified random and transect sampling. Sampling designs may be applied to soil,



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sediment and water; however, the random and systematic random approaches are not practical for sampling water systems, especially flowing water systems.

3.2.1 Judgmental Sampling

Judgmental sampling is the subjective selection of sampling locations based on the professional judgment of the field team. This method is useful to locate and to identify potential sources of contamination. It may not be representative of the full site and is used to document worst case scenarios. For example, groundwater sampling points are typically chosen based on professional judgment, whether permanently installed wells or temporary well points.

3.2.2 Systematic Sampling

Systematic grid sampling involves the collection of samples at fixed intervals when the contamination is assumed to be randomly distributed. A random point is chosen as the origin for the placement of the grid. A grid is constructed over a site and samples are collected from the nodes (where the grid lines intersect). Depending on the number of samples that are required to be collected, the distance between the sampling locations can be adjusted. The representativeness of the sampling may be improved by shortening the distance between sample locations.

Systematic random sampling is used for estimating contaminant concentrations within grid cells. Instead of sampling at each node, a random location is chosen within each grid cell. The systematic grid and random sampling approaches are useful for delineating the extent of contamination, documenting the attainment of clean-up goals, and evaluating and determining treatment and disposal options.

Transect sampling involves one or more transect lines established across the site. Samples are collected at systematic intervals along the transect lines. The number of samples to be collected and the length of the transect line determines the spacing between the sampling points. This type of sampling design is useful for delineating the extent of contamination at a particular site, for documenting the attainment of clean-up goals, and for evaluating and determining treatment and disposal options.

3.2.3 Simple and Stratified Random Sampling

Statistical random sampling includes simple, stratified and systematic sampling. Simple random sampling is appropriate for estimating means and total concentrations, if the site or population does not contain a major trend or pattern of contamination. A statistician will generate the sampling locations based on sound statistical methods. Stratified random sampling is a useful tool for estimating average contaminant concentrations and total amounts of contaminants within specified strata and across the entire site. It is useful when a heterogeneous population or area can be broken down into regions with less variability within the boundaries of a stratum than between the strata. Additionally, strata can be defined based on the decisions that will be made. This type of sampling design uses historical information, known ecological and human receptors, soil type, fate and transport mechanism and other ecological factors to divide the sampling area into smaller regions or strata. Sampling locations are selected from each stratum using random sampling.



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The simple random sampling approach is applied when there are many sample locations and the concentrations are assumed to be homogeneous across a site with respect to the parameter(s) that are going to be analyzed or monitored for. The stratified random sampling approach is useful for sampling drums, evaluating and determining treatment and disposal options, and locating and identifying sources of contamination.

3.3 Sampling Techniques

Sampling is the selection of a representative portion of a larger population or body. The primary objective of all sampling activities is to characterize a site accurately in a way that the impact on human health and the environment can be evaluated appropriately.

3.3.1 Sample Collection Techniques

Sample collection techniques may be either grab or composite. A grab sample is a discrete aliquot representative of a specific location at a given time and collected all at once from one location. The representativeness of such samples is defined by the nature of the materials that are sampled. Samples collected for volatile organic compounds (VOCs) are always grab samples and are never homogenized. Composite samples are non-discrete samples composed of more than one specific aliquot collected at selected sampling locations. Composite samples must be homogenized by mixing prior to putting the sample into containers. Composite samples can, in certain instances, be used as an alternative to analyzing a number of individual grab samples and calculating an average value. Incremental sampling conducted over a grid is a special case of composite sampling and is detailed in SOP #2019, *Incremental Soil Sampling*. Choice of collecting discrete or composite samples is based on project's DQOs.

3.3.2 Homogenization

Mixing of soil and sediment samples is critical to obtain a representative sample. An adequate volume/weight of sample is collected and placed in a stainless steel or Teflon® container, and is thoroughly mixed using a spatula or spoon made of an inert material. Once the sample is thoroughly mixed the sample is placed into sample containers specific for an analysis. Avoid the use of equipment made of plastic or polyvinyl chloride (PVC) when sampling for organic compounds when the reporting limit (RL) is in the parts per billion (ppb) or parts per trillion (ppt) ranges. Refer to SERAS SOP #2012, *Soil Sampling*, for more details on homogenization.

3.3.3 Filtration

In-line filters are used specifically for collecting groundwater samples for dissolved metals analysis and for filtering large volumes of turbid groundwater. Groundwater samples collected for VOCs are typically not filtered due to potential VOC losses. Filtering groundwater is performed to remove silt particulates from samples to prevent interference with the laboratory analysis. The filters used in groundwater sampling are either cartridge type filters inserted into a reusable housing, or are self-contained and disposable. Filter chambers are usually made of polypropylene housing an inert filtering material that removes particles larger than 0.45 micrometers (µm). Refer to SERAS SOP



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#2007, *Groundwater Well Sampling* and SERAS SOP #2013, *Surface Water Sampling*, for more details on filtration techniques.

3.4 Quality Assurance /Quality Control Samples

QA/QC samples provide an evaluation of both the laboratory's and the field sampling team's performance. Including QA/QC samples in a sampling design allows for identifying and measuring sources of error potentially introduced from the time of sample container preparation through analysis. The most common QA/QC samples collected in the field are collocated field duplicates, field replicates, equipment blanks, field blanks and trip blanks. Extra volume/mass is collected for a matrix spike/matrix spike duplicate (MS/MSD) at a frequency of 5% (one in 20 samples). Spiking is performed in the laboratory. For additional information or other QA/QC samples pertinent to sample analysis, refer to SERAS SOP #2005, *Quality Assurance/Quality Control Samples*.

Collocated field duplicates may be collected based on site objectives and used to measure variability associated with the sampling process including sample heterogeneity, sampling methodology, and analytical procedures. Field replicates are field samples obtained from one location, homogenized, and divided into separate containers. This is useful for determining whether the sample has been homogenized properly. Equipment blanks (also known as rinsate blanks) are typically collected at a rate of one per day. The equipment blank is used to evaluate the relative cleanliness of non-dedicated equipment.

3.5 Sample Containers, Preservation, Storage and Holding Times

The amount of sample to be collected, the proper sample container type (i.e., glass, plastic), chemical preservation, and storage requirements are dependent on the matrix sampled and the analyses to be conducted. This information is provided in SERAS SOP #2003, *Sample Storage, Preservation, and Handling*. Field personnel need to be cognizant of any short holding times that warrant immediate shipment/transfer to the laboratory.

3.6 Documentation

Field conditions and site activities must be documented. Scribe will be used to document sample locations and generate chain of custody records. Other field measurements not typically entered into Scribe will be documented in a site-specific logbook or in a personal logbook. All sample documentation will be maintained in accordance with SERAS SOP #2002, *Sample Documentation* and SERAS SOP #4005, *Chain of Custody Procedures*.

4.0 RESPONSIBILITIES

4.1 SERAS Task Leaders

Task Leaders (TLs) are responsible for the overall management of the project. Task Leader responsibilities include ensuring that field personnel are well informed of the sampling requirements for a specific project and that SOP and QA/QC procedures stated in the site-specific QAPP are adhered to, issuing a Field Change Form that documents any changes to sampling activities after the QAPP has been approved and maintaining sample documentation.



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4.2 SERAS Field Personnel

Field personnel are responsible for reading the QAPP prior to site activities and performing sample collection activities as written. They are responsible for notifying the TL of deviations from sample collection protocols which occurred during the execution of sampling activities. Field staff will collect samples and prepare documentation in accordance with SERAS SOP #2002, *Sample Documentation*. In addition, field personnel are responsible for reading and conforming to the approved site-specific Health and Safety Plan (HASP).

4.3 SERAS Program Manager

The SERAS Program Manager is responsible for the overall technical and financial management of the project.

4.4 SERAS QA/QC Officer

The QA/QC Officer is responsible for reviewing this SOP and ensuring that the information in this SOP is updated on a timely basis. Compliance to this SOP may be monitored by either conducting a field audit or reviewing deliverables prepared by the SERAS TL.

4.5 Health and Safety (H&S) Officer

The H&S Officer is responsible for ensuring that a HASP has been written in conformance with SOP # 3012, *SERAS Health and Safety Guidelines for Field Activities* and approved prior to field activities. Additionally, the H&S Officer is responsible for ensuring that SERAS site personnel's H&S training is current as per SOP # 3006, *SERAS Field Certification Program* and that their medical monitoring is current as per *SERAS SOP #3004, SERAS Medical Monitoring Program*.

STANDARD OPERATING PROCEDURE APPROVAL AND CHANGE FORM

Scientific, Engineering, Response and Analytical Services
2890 Woodbridge Avenue Building 209 Annex
Edison New Jersey 08837-3679

STANDARD OPERATING PROCEDURE

Title: Chip, Wipe and Sweep Sampling

Approval Date: 06/30/2017

Effective Date: 06/30/2017

SERAS SOP Number: 2011, Rev 1.1

Authors

Name Amy DuBois

Title SERAS Air Environmental Scientist

Signature 

Date

6/27/17

Name

Title

Signature

Date

Approvals

Name Philip Solinski

Title SERAS Air Response Chemist

Signature 

Date

6/27/17

Name Donna Getty

Title SERAS Statistician/QC Reviewer

Signature 

Date

6/27/17

Name Deborah Killeen

Title SERAS QA/QC Officer

Signature 

Date

6/27/17

Name Kevin Taylor

Title SERAS Program Manager

Signature 

Date

6/27/17

The top row of this table shows the most recent changes to the controlled document. For previous revision history information, archived versions of this document are maintained by the SERAS QA/QC Officer on the SERAS local area network (LAN).

History	Effective Date
Supersedes: SOP #2011, Revision 1.0 dated 08/28/15, U.S. EPA Contract EP-W-09-031	06/30/17
Editorial changes, added Appendix A (sampling worksheet), added personnel competency records to Section 9.0	06/30/17
Supersedes: SOP #2011, Revision 0.0 dated 11/16/1994, U.S. EPA Contract 68-03-3482	08/31/15
Editorial changes	08/31/15



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CHIP, WIPE, AND SWEEP SAMPLING

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4.0	INTERFERENCES AND POTENTIAL PROBLEMS
5.0	EQUIPMENT/APPARATUS
6.0	REAGENTS
7.0	PROCEDURES
7.1	Preparation
7.2	Chip Sample Collection
7.3	Wipe Sample Collection
7.4	Sweep Sample Collection
8.0	CALCULATIONS
9.0	QUALITY ASSURANCE/QUALITY CONTROL
10.0	DATA VALIDATION
11.0	HEALTH AND SAFETY
12.0	REFERENCES
13.0	APPENDICES
	A – Attachment

SUPERCEDES: SOP #2011; Revision 1.0; 08/28/15; U.S. EPA Contract EP-W-09-031

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CHIP, WIPE, AND SWEEP SAMPLING

1.0 SCOPE AND APPLICATION

This standard operating procedure (SOP) outlines the recommended protocol and equipment for collection of representative chip, wipe, and sweep samples to monitor potentially contaminated surfaces. This method of monitoring surficial contamination is appropriate for surfaces contaminated with non-volatile species of analytes (i.e., polychlorinated biphenyls [PCBs], polychlorinated dibenzo-p-dioxins [PCDDs], polychlorinated dibenzofurans [PCDFs], metals, cyanide, etc.). Detection limits are analyte specific. Sample size should be determined based upon the detection limit desired and the amount of sample requested by the analytical laboratory. Typical sample area is one square foot (ft²) for lead and 100 square centimeters (cm²) for many other analytes. However, based upon sampling location, the sample size may need modification due to area configuration.

A Quality Assurance Project Plan (QAPP) in Uniform Federal Policy (UFP) format describing the project objectives must be prepared prior to deploying for a sampling event. The sampler needs to ensure that the methods used are adequate to satisfy the data quality objectives listed in the QAPP for a particular site.

The procedures in this SOP may be varied or changed as required, dependent on site conditions, equipment limitations or other procedural limitations. In all instances, the procedures employed must be documented on a Field Change Form and attached to the QAPP. These changes must be documented in the final deliverable.

2.0 METHOD SUMMARY

Since surface situations vary widely, no universal sampling method can be recommended. Rather, the method and implements used must be tailored to suit a specific sampling site. The sampling location should be selected based upon the potential for contamination as a result of manufacturing processes or personnel practices.

Chip sampling is appropriate for porous surfaces and is generally accomplished with either a hammer and chisel, or an electric hammer. The sampling device should be laboratory cleaned and wrapped in clean aluminum foil until ready for use. To collect the sample, a measured and marked off area is chipped both horizontally and vertically to an even depth of 1/8 inch. The sample is then transferred to the proper sample container.

Wipe samples are collected from smooth surfaces to indicate surficial contamination; a sample location is measured and marked off. While wearing a new pair of contaminant-free gloves, the wipe sampling media (e.g., a sterile gauze pad or filter paper) is opened, and wetted with solvent. The solvent used is dependent on the surface and contaminant being sampled. This pad is then stroked firmly over the sample surface in a reproducible pattern, first vertically, then horizontally, to ensure complete coverage. The wipe sampling media is then transferred to the sample container.

Sweep sampling is an effective method for the collection of dust or residue on porous or non-porous surfaces. To collect such a sample, an appropriate area is measured off. Then, while wearing a new pair of disposable contaminant-free gloves, a dedicated brush is used to sweep material into a dedicated dust pan. The sample is then transferred to the proper sample container.

Samples collected by all three methods are then sent to the laboratory for analysis.



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3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

Depending on the contaminants to be sampled, samples should be stored out of direct sunlight to reduce photodegradation, cooled on ice to less than or equal to (\leq) six degrees Celsius ($^{\circ}\text{C}$) and shipped to the laboratory performing the analysis. Appropriately sized laboratory cleaned, glass sample jars should be used for sample collection. The amount of sample required will be determined in concert with the analytical laboratory.

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

This method has few significant interferences or problems. Typical problems result from rough, porous surfaces which may be difficult to wipe, chip, or sweep.

5.0 EQUIPMENT/APPARATUS

Equipment required for performing chip, wipe, or sweep sampling is as follows:

- Laboratory cleaned or certified clean sample containers of proper size and composition
- Site logbook
- Sample analysis request forms
- Chain of Custody (COC) records
- Custody seals
- Field data sheets
- Sample labels
- Scribe Software
- Tape measure
- Disposable contaminant-free gloves
- Plastic sheet or cardboard template (100 cm^2 or 1 ft^2)
- Sterile wrapped gauze pad (3 inch [in.] x 3 in.) or appropriate filter paper
- Laboratory cleaned paint brush
- Stainless steel laboratory cleaned chisel
- Aluminum foil
- Camera to document exact locations

NOTE: This check list is provided as a guide and is not intended to be all-inclusive.

6.0 REAGENTS

- Appropriate pesticide grade or high performance liquid chromatography (HPLC) grade solvent, depending on the analyte of interest
- Distilled/deionized water

For non-dedicated equipment, reagents will be utilized for decontamination of sampling equipment. Decontamination solutions are specified in SERAS SOP #2006, *Sampling Equipment Decontamination*.

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CHIP, WIPE, AND SWEEP SAMPLING

7.0 PROCEDURES

7.1 Preparation

1. Determine the extent of the sampling effort and the sampling methods to be employed. Additionally, the types and amounts of equipment and supplies need to be determined.
2. Obtain necessary sampling and monitoring equipment.
3. Decontaminate or pre-clean equipment, and ensure that it is in working order.
4. Prepare scheduling and coordinate with staff, clients, and regulatory agency, if appropriate.
5. Perform a general site survey prior to site entry in accordance with the site-specific Health and Safety Plan (HASP).
6. Mark all sampling locations. If required, the proposed locations may be adjusted based on site access, property boundaries and surface obstructions.

7.2 Chip Sample Collection

Sampling of porous surfaces is generally accomplished by using a chisel and hammer or electric hammer. The sampling device should be laboratory cleaned or field decontaminated as per SERAS SOP# 2006, *Sampling Equipment Decontamination*. It should then be wrapped in clean aluminum foil and kept in this wrapping until it is needed. Each sampling device should be used for only one sample until decontamination is performed again.

Choose appropriate sampling points; measure off the designated area. Photodocumentation may be required based on project objectives. Record surface area to be chipped.

1. Don a new pair of disposable contaminant-free gloves.
2. Use a cleaned chisel or equivalent sampling device and chip the sample area horizontally, then vertically to an even depth of approximately 1/8 inch.
3. Place the sample in an appropriately prepared sample container with a Teflon-lined cap.
4. Cap the sample container, attach the label and place in a plastic bag.
5. Record all pertinent data in the site logbook, on field data sheets and in Scribe. Complete the Chip Sampling Sheet (Appendix A) and COC record.
6. As appropriate, store samples out of direct sunlight and cool to $\leq 6^{\circ}\text{C}$.
7. Follow proper decontamination procedures then deliver sample(s) to the laboratory for analysis.

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7.3 Wipe Sample Collection

Wipe sampling is accomplished by using clean sampling media (e.g., a sterile gauze pad, moist wipes for metals, filter paper or special wipes for asbestos), adding a solvent (if not already provided with the wipe) in which the contaminant is most soluble, and then wiping a pre-determined, pre-measured area. The sample is packaged in an amber jar to prevent photodegradation and packed in coolers for shipment to the lab. Each sampling media is used for only one wipe sample. Consult with the laboratory conducting the analysis to ensure that the media and solvent is appropriate for the analysis. The media and solvent may be acquired from the laboratory performing the analysis or purchased separately.

1. Choose appropriate sampling points; measure off the designated area. Photodocumentation may be required based on project objectives.
2. Record surface area to be wiped or use 100 cm² (or 1-ft²) paper or plastic templates.
3. Don a new pair of disposable contaminant-free gloves.
4. Open sampling media (e.g., a 3-in. x 3-in. sterile gauze pad) and record the lot number.
5. Moisten the sampling media with one to two milliliters of the appropriate solvent of choice or apply sufficient solvent to moisten approximately 80 percent (%) of the media. Do not add excess solvent as this may cause loss of sample.
6. Wipe the marked surface area using firm strokes vertically and horizontally. Continue with approximately 10 strokes in each direction until the surface has been completely covered.
7. After completing the first 10 strokes, fold the sampling media exposed surface inward and continue surface wiping. Upon completion of the remaining 10 strokes, fold the exposed surface inward again, if possible.
8. Place the sampling media in a 40-milliliter amber vial or an appropriately prepared sample container with a Teflon-lined cap.
9. Cap the sample container, attach the label and place in a plastic bag. Record all pertinent data in the site logbook, on field data sheets and in Scribe. Complete the Wipe Sampling Sheet (Appendix A) and COC record.
10. As appropriate, store samples in a cooler out of direct sunlight using a 40-milliliter amber vial and cool to $\leq 6^{\circ}\text{C}$ using ice.
11. Follow proper decontamination procedures, and then deliver sample(s) to the laboratory for analysis.

7.4 Sweep Sample Collection

Sweep sampling is appropriate for bulk contamination. This procedure utilizes a dedicated, hand



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held sweeper brush to acquire a sample from a pre-measured area.

1. Choose appropriate sampling points; measure off the designated area. The area sampled should be large enough to provide sufficient sample for analysis. Photodocumentation may be required based on project objectives.
2. Record the surface area to be swept.
3. Don new pair of disposable contaminant-free gloves.
4. Sweep the measured area using a dedicated clean brush; collect the sample in a dedicated dust pan.
5. Transfer sample from dust pan to sample container.
6. Cap the sample container, attach the label and custody seal, and place in a plastic bag. Record all pertinent data in the site log book, on field data sheets and in Scribe. Complete the Sweep Sampling Data Sheet (Appendix A) and COC record.
7. As appropriate, store samples out of direct sunlight and cool to $\leq 6^{\circ}\text{C}$.
8. Follow proper decontamination procedures, and then deliver sample(s) to the laboratory for analysis.

8.0 CALCULATIONS

Results are usually provided in milligram per gram (mg/g), microgram per gram ($\mu\text{g/g}$), mass per unit area, or other appropriate measurement. Calculations are typically done by the laboratory.

9.0 QUALITY ASSURANCE/QUALITY CONTROL

Specific Quality Assurance/Quality Control (QA/QC) activities that apply to the implementation of these procedures will be listed in the QAPP prepared for the applicable sampling event. The following general QA procedures will also apply:

1. All sample collection data, including sample collection methods, times of collection, analyses required, and decontamination procedures (if any) must be documented on field datasheets or in site logbooks.
2. For wipe samples, a field blank should be collected for each sampling event. This consists of the appropriate sampling media, wetted with the appropriate solvent, and placed in a 40-milliliter amber glass vial or in an appropriately prepared container with a Teflon-lined cap. The blank will help identify potential introduction of contaminants via the sampling methods, the media, solvent or sample container. Alternatively, the template may be wiped, if not dedicated to ensure that no transfer of contaminants occurs from area to area.
3. Records will be maintained, documenting the level of personnel's competency in performing the



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methodology presented in this SOP.

Specific QA activities for chip and sweep samples should be determined on a site-specific basis.

10.0 DATA VALIDATION

Data verification (completeness checks) must be conducted to ensure that all data inputs are present for ensuring the availability of sufficient information. This may include but is not limited to: location information, approximate area, sample number, date and time of collection, and solvent and media lot numbers. These data are essential to providing an accurate and complete final deliverable. The SERAS Task Leader (TL) is responsible for completing the UFP-QAPP verification checklist for each project.

11.0 HEALTH AND SAFETY

When working with potentially hazardous materials, follow United States Environmental Protection Agency (U.S. EPA), Occupational Safety and Health Administration (OSHA) and SERAS health and safety guidelines. More specifically, depending upon the site-specific contaminants, various protective programs must be implemented prior to sampling. The site's HASP should be reviewed with specific emphasis placed on the protection program planned for the sampling tasks. Standard safe operating practices should be followed such as minimizing contact with potential contaminants.

12.0 REFERENCES

Brookhaven National Laboratory, Surface Wipe Sampling Procedure, February 9, 2009

NJDEP Field Sampling Procedures Manual, August 2005

OSHA Instruction CPL 2-2.20B: Sampling for Surface Contamination, February 5, 1990

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*These sections affected by Revision 1.0.

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1.0 SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to describe procedures for the collection of representative surface soil samples. Sampling depths are assumed to be those that can be reached without the use of a drill rig, direct-push technology, or other mechanized equipment (except for a back-hoe). Sample depths typically extend up to 1-foot below ground surface. Analysis of soil samples may define the extent of contamination, determine whether concentrations of specific contaminants exceed established action levels, or if the concentrations of contaminants present a risk to public health, welfare, or the environment.

These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required, dependent upon site conditions, equipment limitations, or limitations imposed by the procedure. In all instances, the ultimate procedures employed should be documented and associated with a final report.

Mention of trade names or commercial products does not constitute United States Environmental Protection Agency (U.S. EPA) endorsement or recommendation for use.

2.0 METHOD SUMMARY

Surface soil samples can be used to investigate contaminants that are persistent in the near surface environment. Contaminants that are detected in the near surface environment may extend to considerable depths, may migrate to the groundwater, surface water, the atmosphere, or may enter biological systems.

Soil samples may be collected using a variety of methods and equipment depending on the depth of the desired sample, the type of sample required (discrete or composite), and the soil type. Near-surface soils may be easily sampled using a spade, trowel, and/or scoop. Sampling at greater depths may be performed using a hand auger, continuous-flight auger, trier, split-spoon sampler, or, if required, a backhoe.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

Samples must be cooled and maintained at 4°C and protected from sunlight immediately upon collection to minimize any potential reaction. The amount of sample to be collected, proper sample container type and handling requirements are discussed in the Scientific, Engineering, Response Analytical Services (SERAS) SOP #2003, *Sample Storage, Preservation and Handling*.

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

There are two primary problems associated with soil sampling: 1) cross contamination of samples, and 2) improper sample collection. Cross contamination problems can be eliminated or minimized through the use of dedicated sampling equipment. If this is not possible or practical, decontamination of sampling equipment is necessary. The guidelines for preventing, minimizing and limiting cross contamination of samples are discussed in the Environmental Response Team (ERT)/SERAS SOP #2006, *Sampling Equipment Decontamination*. Improper sample collection procedures can disturb the sample matrix, resulting in volatilization of contaminants, compaction of the sample, or inadequate homogenization of the samples (when required), resulting in variable, non-representative results.

5.0 EQUIPMENT/APPARATUS



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Soil sampling equipment includes the following:

- Site maps/plot plan
- Safety equipment, as specified in the site-specific Health and Safety Plan (HASP)
- Traditional survey equipment or global positioning system (GPS)
- Tape measure
- Survey stakes or flags
- Camera and image collection media
- Stainless steel, plastic*, or other appropriate homogenization bucket, bowl or pan
- Appropriate size sample containers
- Ziplock plastic bags
- Site logbook
- Labels
- Chain of Custody records and custody seals
- Field data sheets and sample labels
- Cooler(s)
- Ice
- Vermiculite
- Decontamination supplies/equipment
- Plastic sheeting
- Spade or shovel
- Spatula(s)
- Scoop(s)
- Plastic* or stainless steel spoons
- Trowel(s)
- Continuous flight (screw) auger
- Bucket auger
- Post hole auger
- Extension rods
- T-handle
- Sampling trier
- Thin wall tube sampler
- Split spoon sampler
- Soil core sampler
 - Tubes, points, drive head, drop hammer, puller jack and grip
- Photoionization detector (PID), Flame ionization detector (FID) and/or Respirable Aerosol Monitor (RAM)

- Backhoe (as required)
- En Core® samplers

* Not used when sampling for semivolatile compounds.

6.0 REAGENTS

Decontamination solutions are specified in ERT/SERAS SOP #2006, *Sampling Equipment Decontamination*, and the site specific work plan.



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7.0 PROCEDURES

7.1 Preparation

1. Determine the extent of the sampling effort, the analytes to be determined, the sampling methods to be employed, and the types and amounts of equipment and supplies required to accomplish the assignment.
2. Obtain the necessary sampling and air monitoring equipment.
3. Prepare schedules and coordinate with staff, client, and regulatory agencies, as appropriate.
4. Perform a general site reconnaissance survey prior to site entry in accordance with the site specific HASP.
5. Use stakes or flags to identify and mark all sampling locations. Specific site factors, including extent and nature of contamination, should be considered when selecting sample locations. If required, the proposed locations may be adjusted based on site access, property boundaries, and surface obstructions. All staked locations should be utility-cleared prior to soil sampling; utility clearances must be confirmed before beginning intrusive work.
6. Pre-clean and decontaminate equipment in accordance with the site specific work plan, and ensure that it is in working order.

7.2 Sample Collection

7.2.1 Surface Soil Samples

The collection of samples from near-surface soil can be accomplished with tools such as spades, shovels, trowels, and scoops. The over-burden or over-lying surface material is removed to the required depth and a stainless steel or plastic scoop is used to collect the sample. Plastic utensils are not to be used when sampling for semivolatile compounds.

This method can be used in most soil types but is limited to sampling at or near the ground surface. Accurate, representative samples can be collected by this procedure depending on the care and precision demonstrated by the sample team member. A flat, pointed mason trowel to cut a block of the desired soil is helpful when undisturbed profiles are required. Tools plated with chrome or other materials must not be used.

The following procedure is used to collect surface soil samples:

1. If volatile organic compound (VOC) contamination is suspected, use a PID to monitor the sampler's breathing zone during soil sampling activities.
2. Using a pre-cleaned, stainless steel scoop, plastic spoon, or trowel, remove and discard sticks, rocks, vegetation and other debris from the sampling area.
3. Accumulate an adequate volume of soil, based on the type(s) of analyses to be performed, in



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a stainless, plastic or other appropriate container.

4. If volatile organic analysis is to be performed, immediately transfer the sample directly into an appropriate, labeled sample container with a stainless steel spoon, or equivalent, and secure the cap tightly to ensure that the volatile fraction is not compromised. Thoroughly mix the remainder of the soil to obtain a sample that is representative of the entire sampling interval. Then, either place the sample into appropriate, labeled containers and secure the caps tightly, or, if composite samples are to be collected, place a sample from another sampling interval or location into the homogenization container and mix thoroughly. When compositing is complete, place the sample into appropriate, labeled containers and secure the caps tightly.

7.2.2 Sampling at Depth with Augers and Thin Wall Tube Samplers

This system consists of an auger, head, a series of extensions, and a "T" handle (Figure 1, Appendix A). The auger is used to bore a hole to a desired sampling depth, and is then withdrawn. The sample may be collected directly from the auger head. If additional sample volume is required, multiple grabs at the same depth are made. If a core sample is to be collected, the auger head is then replaced with a tube auger. The system is then lowered down the borehole, and driven into the soil to the completion depth. The system is withdrawn and the core is collected.

Several types of augers are available; these include bucket or tube type, and continuous flight (screw) or post-hole augers. Bucket or tube type augers are better for direct sample recovery because a large volume of sample can be collected from a discrete area in a short period of time. When continuous flight or post-hole augers are used, the sample can be collected directly from the flights or from the borehole cuttings. The continuous flight or post-hole augers are satisfactory when a composite of the complete soil column is desired, but have limited utility for sample collection as they cannot be used to sample a discrete depth.

The following procedure is used for collecting soil samples with an auger:

1. Attach the auger head to an extension rod and attach the "T" handle.
2. Clear the area to be sampled of surface debris (e.g., twigs, rocks, litter). It may be advisable to remove a thin layer of surface soil for an area approximately six inches in radius around the sampling location.
3. Begin augering, periodically removing and depositing accumulated soils onto a plastic sheet spread near the hole. This prevents the accidental brushing of loose material back down the borehole when removing the auger or adding extension rods. It also facilitates refilling the hole, and avoids possible contamination of the surrounding area.
4. After reaching the desired depth, slowly and carefully remove the auger from the hole. When sampling directly from the auger head, proceed to Step 10.
5. Remove auger tip from the extension rods and replace with a tube sampler. Install the



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proper cutting tip.

6. Carefully lower the tube sampler down the borehole. Gradually force the tube sampler into the soil. Do not scrape the borehole sides. Avoid hammering the rods as the vibrations may cause the boring walls to collapse.
7. Remove the tube sampler and unscrew the extension rods.
8. Remove the cutting tip and the core from the device.
9. Discard the top of the core (approximately 1 inch), as this possibly represents material collected before penetration of the layer of concern. Place the core or a discrete portion of the core into the appropriate labeled sample container using a clean, decontaminated stainless steel spoon. If required, homogenize the sample as described in Step 10.
10. If VOC analysis is to be performed, transfer the sample directly from the auger head into an appropriate, labeled sample container with a stainless steel spoon, or equivalent and secure the cap tightly.
11. If another sample is to be collected in the same hole, but at a greater depth, reattach the auger head to the drill assembly, and follow steps 3 through 11, making sure to decontaminate the auger head and tube sampler between samples.
12. Abandon the hole according to applicable state regulations.

7.2.3 Sampling at Depth with a Trier

The system consists of a trier and a "T" handle. The auger is driven into the soil to be sampled and used to extract a core sample from the appropriate depth.

The following procedure is used to collect soil samples with a sampling trier:

1. Insert the trier (Figure 2, Appendix A) into the material to be sampled at a zero degree to forty-five degree (0° to 45°) angle from the soil surface plane. This orientation minimizes the spillage of sample.
2. Rotate the trier once or twice to cut a core of material.
3. Slowly withdraw the trier, making sure that the slot is facing upward.
4. If VOC analyses are required, transfer the sample directly from the trier into an appropriate, labeled sample container with a stainless steel spoon, or equivalent device and secure the cap tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container and mix thoroughly to obtain a sample that is representative of the entire sampling interval. Then, either place the sample into appropriate, labeled containers and secure the caps tightly; if composite samples are to be collected, place a sample from another sampling interval into the



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homogenization container and mix thoroughly. When compositing is complete, place the sample into appropriate, labeled containers and secure the caps tightly.

7.2.4 Sampling at Depth with a Split Spoon (Barrel) Sampler

Split spoon sampling is generally used to collect undisturbed soil cores of 18- or 24- inches in length. A series of consecutive cores may be extracted with a split spoon sampler to give a complete soil column profile, or an auger may be used to drill down to the desired depth for sampling. The split spoon is then driven to its sampling depth through the bottom of the augured hole and the core extracted.

When split spoon sampling is performed to gain geologic information, all work should be performed in accordance with American Society for Testing and Materials (ASTM) D1586-99, "*Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils*".

The following procedures are used for collecting soil samples with a split spoon:

1. Assemble the sampler by aligning both sides of the barrel and then screwing the drive shoe on the bottom and the head piece on top.
2. Place the sampler at a 90 degree (90°) angle to the sample material.
3. Using a well ring, drive the sampler. Do not drive past the bottom of the head piece or compression of the sample will result.
4. Record in the site logbook or on field data sheets the length of the tube used to penetrate the material being sampled, and the number of blows required to obtain the sample.
5. Withdraw the sampler, and open it by unscrewing the bit and head, and then splitting the barrel. The amount of recovery and soil type should be recorded on the boring log. If a split sample is desired, a cleaned, stainless steel knife should be used to divide the tube contents in half, longitudinally. This sampler is typically available in 2- and 3.5-inch diameter tubes. A larger barrel (diameter and/or length) may be necessary to obtain the required sample volume.
6. Without disturbing the core, transfer it to the appropriately labeled sample container(s) and seal tightly. Place the remainder of the sample into a stainless steel, plastic, or appropriate homogenization container, and mix thoroughly to obtain a sample that is representative of the entire sampling interval. Then, either place the sample into the appropriate, labeled containers and secure the caps tightly, or if composite samples are to be collected, place a sample from another sampling interval or location into the homogenization container and mix thoroughly. When compositing is complete, place the sample into the appropriate, labeled containers and secure the caps tightly.
7. Abandon the hole according to applicable state regulations.



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7.2.5 Test Pit/Trench Excavation

A backhoe can be used to remove sections of soil when a detailed examination of stratigraphy and soil characteristics is required. The following procedures are used for collecting soil samples from test pits or trenches:

1. Prior to any excavation with a backhoe, it is imperative to ensure that all sampling locations are clear of overhead and buried utilities.
2. Review the site specific HASP and ensure that all safety precautions including appropriate monitoring equipment are installed as required.
3. Using the backhoe, excavate a trench approximately three feet wide and approximately one foot deep below the cleared sampling location. Place excavated soils on plastic sheets. Trenches greater than five feet deep must be sloped or protected by a shoring system, as required by Occupational Safety and Health Administration (OSHA) regulations.
4. A shovel is used to remove a one to two inch layer of soil from the vertical face of the pit where sampling is to be done.
5. Samples are taken using a trowel, scoop, or coring device at the desired intervals. Be sure to scrape the vertical face at the point of sampling to remove any soil that may have fallen from above, and to expose fresh soil for sampling. In many instances, samples can be collected directly from the backhoe bucket.
6. If VOC analyses are required, transfer the sample into an appropriate, labeled sample container with a stainless steel spoon, or equivalent and secure the cap tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a sample representative of the entire sampling interval. Then, either place the sample into appropriate, labeled containers and secure the caps tightly; or, if composite samples are to be collected, place a sample from another sampling interval into the homogenization container and mix thoroughly. When compositing is complete, place the sample into the appropriate, labeled containers and secure the caps tightly.
7. Abandon the pit or excavation according to applicable state regulations.

7.2.6 Sampling for VOCs in Soil Using an En Core® Sampler

An En Core® sampler is a single-use device designed to collect and transport samples to the laboratory. The En Core® sampler is made of an inert composite polymer and reduces the open-air handling of soil samples in the field and in the laboratory; thereby, minimizing losses of VOCs.

1. Assemble the coring body, plunger rod and T-handle according to the instructions provided with the En Core® sampler.



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2. Turn the T-handle with the T-up and the coring body down and push the sampler into the soil until the coring body is completely full. Remove the sampler from the soil. Wipe excess soil from the coring body exterior.
3. Cap the coring body while it is still on the T-handle. Push the cap over the flat area of the ridge. Be sure that the cap is seated properly to seal the sampler. Push and cap to lock arm in place.
4. Remove the capped sampler by depressing the locking lever on the T-handle while twisting and pulling the sampler from the T-handle.
5. Attach the label to the coring body cap, place in a plastic zippered bag, seal and put on ice.

Generally, three En Core® samplers are required for each sample location. These samplers are shipped to the laboratory where the cap is removed and the soil samples are preserved with methanol or sodium bisulfate.

8.0 CALCULATIONS

This section is not applicable to this SOP.

9.0 QUALITY ASSURANCE/QUALITY CONTROL

There are no specific quality assurance (QA) activities that apply to the implementation of these procedures. However, the following general QA procedures apply:

2. All data must be documented in site logbooks or on field data sheets. At a minimum, the following data is recorded:

Sampler's name and affiliation with project
Sample number
Sample location
Sample depth
Approximate volume of sample collected
Type of analyses to be performed
Sample description
Date and time of sample collection
Weather conditions at time of sampling
Method of sample collection
Sketch of sample location

2. All instrumentation must be operated in accordance with applicable SOPs and/or the manufacturer's operating instructions, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior to sampling/operation, and must be documented.
3. The types of quality control (QC) samples to be collected in the field shall be documented in the site-specific Work Plan.



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10.0 DATA VALIDATION

This section is not applicable to this SOP.

11.0 HEALTH AND SAFETY

When working with potentially hazardous materials, follow U.S. EPA, OSHA and corporate health and safety procedures, in addition to the procedures specified in the site specific HASP.

12.0 REFERENCES

Mason, B.J. 1983. *Preparation of Soil Sampling Protocol: Technique and Strategies*. EPA-600/4-83-020.

Barth, D.S. and B.J. Mason. 1989. *Soil Sampling Quality Assurance User's Guide*. EPA-600/8-89-046.

U.S. Environmental Protection Agency. 1984. *Characterization of Hazardous Waste Sites - A Methods Manual: Volume II*. Available Sampling Methods, Second Edition. EPA-600/4-84-076.

de Vera, ER, B.P. Simmons, R.D. Stephen, and D.L. Storm. 1980. *Samplers and Sampling Procedures for Hazardous Waste Streams*. EPA-600/2-80-018.

American Society for Testing and Materials. *Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils*. Method D 1586-99.

En Novative Technologies, Inc. 2001. *En Core® Sampler Sampling Procedures*. Web site access. March 13, 2001.



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Figures

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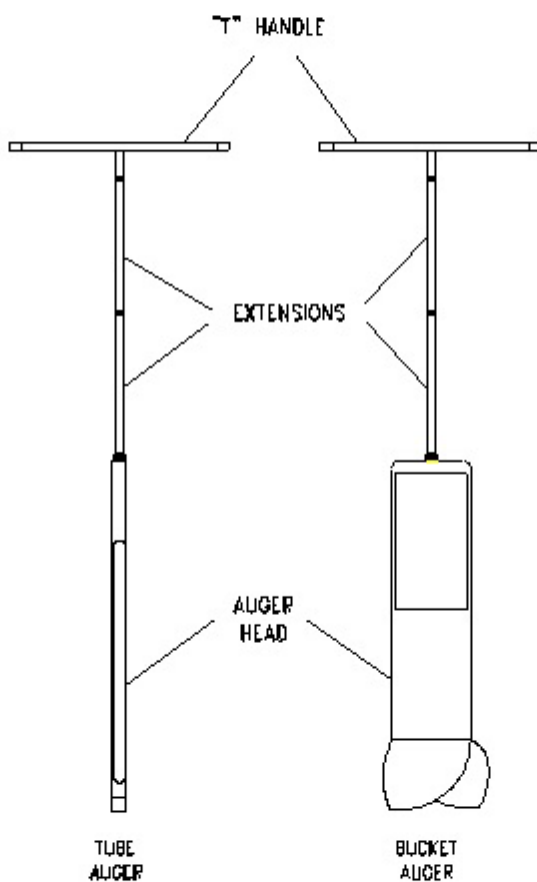
July 2001



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FIGURE 1. Sampling Augers

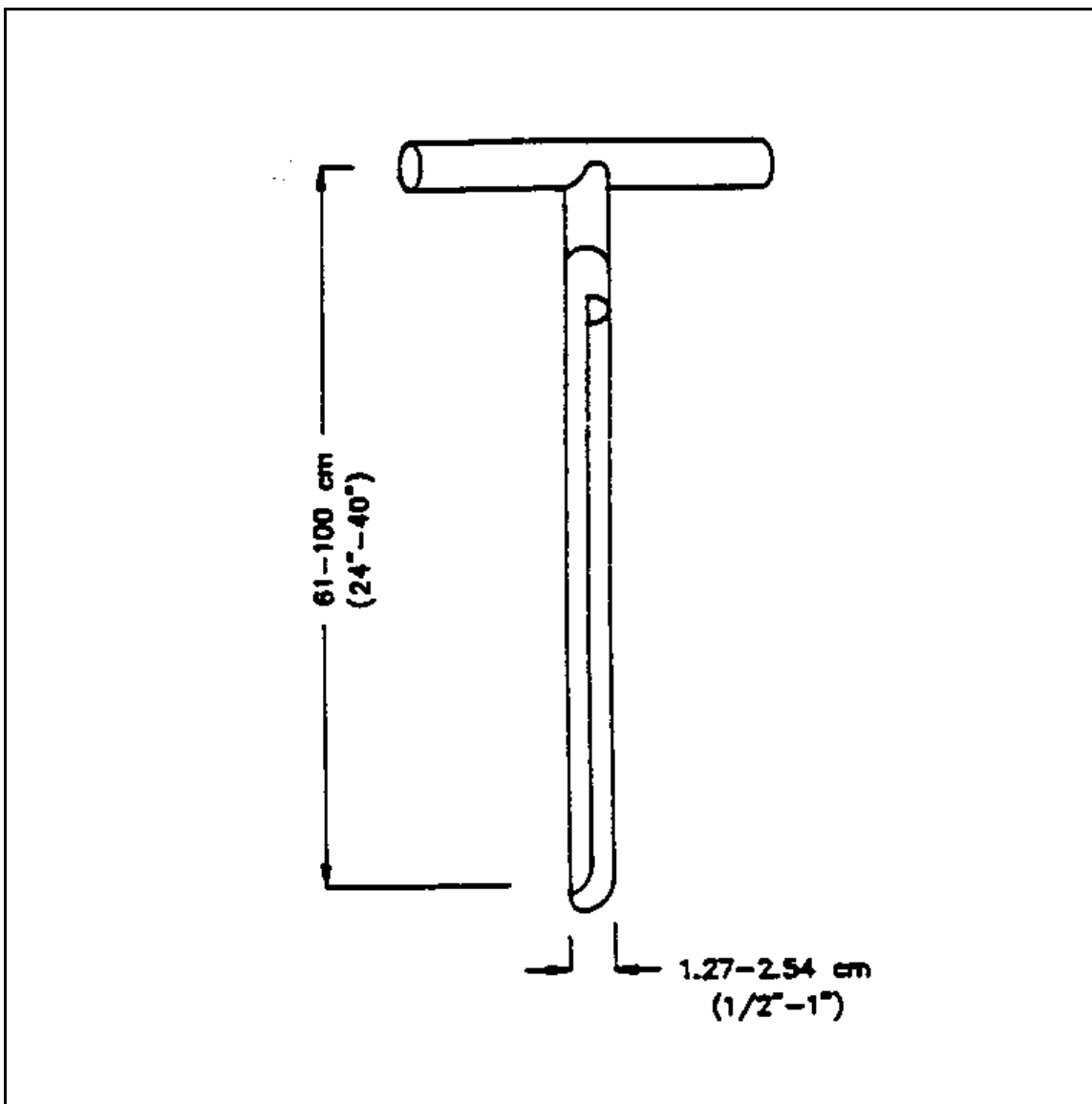




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1.0 SCOPE AND APPLICATION

This standard operating procedure (SOP) describes the start-up, check out, operation, calibration and routine use of the Thermo Scientific, Inc. DataRAM 4DR4000 particulate monitor. The procedures and figures contained in this SOP are taken from the copyrighted *MODEL DR-4000 DataRAM 4 INSTRUCTION MANUAL* (2003). Some material is excerpted without change from this manual. This SOP will be used for educational and training purposes only.

A Quality Assurance Project Plan (QAPP) in Uniform Federal Policy (UFP) format describing the project objectives must be prepared prior to deploying for a sampling event. The sampler needs to ensure that the methods used are adequate to satisfy the data quality objectives listed in the QAPP for a particular site.

The procedures in this SOP may be varied or changed as required, dependent on site conditions, equipment limitations or other procedural limitations. In all instances, the procedures employed must be documented on a Field Change Form and attached to the QAPP. These changes must be documented in the final deliverable.

2.0 METHOD SUMMARY

The DataRAM 4 is a high sensitivity, two-wavelength nephelometric monitor whose light scattering sensing configuration has been optimized for the measurement of the fine particle fraction of airborne dust, smoke, fumes, and mists in ambient, atmospheric, industrial, research, and indoor environments. The DataRAM 4 provides direct continuous readout and electronic recording of particulate data including concentration, particle size, scattering coefficient, and visual range. Refer to the DataRAM 4 User's Manual for detailed operating procedures. Advanced users should consult Appendix C, *Principle of Operation* for a more detailed explanation of the principle of operation.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

This section is not applicable to this SOP.

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

- Good measurement accuracy is dependent on the measured aerosol having a wide particle size distribution, that is, the more monodisperse the aerosol, the lower the accuracy.
- Measurement accuracy may be affected due to differential light scattering by particles with equivalent aerodynamic diameters, but with different optical characteristics, such as density, refractive index, size, shape, and composition.
- Light scattering in the Mie particle region is complex, and the conversion of Mie scattering to mass units may introduce measurement errors.
- High humidity may cause elevated readings.

WARNING: The DataRAM 4 must be protected from all forms of precipitation.

5.0 EQUIPMENT/APPARATUS

The following equipment is provided for the operation and transport of the DataRAM 4 particulate mass monitor:



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- Base unit and enclosure
- Omni-directional sampling inlet and adapter
- In-line Impactor Head (10 and 2.5 micrometer [μm])
- Temperature conditioning heater
- Instruction Manual
- Communications software
- Digital output cable
- Universal charger/power supply unit
- Analytical filter holder
- Pelican storage and transport cases
- Optional Isokinetic Sampling Kit

6.0 REAGENTS

This section is not applicable to this SOP.

7.0 PROCEDURES

7.1 Air Sampling Guidelines

7.1.1 Area Monitoring

For typical short term area monitoring applications, such as landfill fires, forest fires or road construction, the DataRAM 4 should be placed and operated centrally within the area to be monitored, away from localized air currents such as those caused by fans, blowers, ventilation intakes or exhausts. This is to ensure representative sampling.

7.1.2 Ambient Monitoring

For typical long term ambient air monitoring applications, such as municipality Continuous Air Monitoring (CAM) sites:

- The sampling inlet should be away and above any obstructions whose wake may affect sampling representativeness.
- The inlet should be at least 1 meter above the ground or any major horizontal surface, such as, a roof.
- The Omni-directional Inlet should be used under typically horizontal and variable wind conditions to prevent loss of particles with aerodynamic diameters larger than 1 μm .
- At ambient relative humidity above 65 percent (%) to 70% airborne particles are likely to grow by accretion of water. If only the solid portion of the particulates is to be measured, the Temperature Conditioning Heater should be used, especially when monitoring under fog or water mist conditions.
- To operate the DataRAM 4 outdoors, provisions must be made to protect it from environmental extremes such temperatures beyond its specified range, and any form of precipitation. A small shelter or roof may be required with a heating source that does not create any perturbation in airborne particulate levels. Heating sources with fan motors can be an issue (i.e. move particulates into the air column)



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as well as wood or coal burning stoves due to production of airborne particulate matter.

7.1.3 Extractive Sampling

To sample from an enclosure or a duct/stack, a length of tubing is required to transfer the extracted sample to the DataRAM 4. The following guidelines should be applied:

- Minimize tubing length, especially horizontally running lengths.
- Minimize the number bends and angle of change in direction.
- Minimize tubing inner diameter thus maximizing transport velocity (a practical lower limit of about 2 millimeters (mm), or 0.08 inch (in.) ID is indicated for reasons of excessive pressure drop).
- If possible, changes in inner diameter should be incremental in the direction of flow, that is, the inner diameter should increase in the direction of flow.
- Use non-electrostatic tubing, such as, electrically grounded metal tubing or conductive plastic tubing, or Tygon. Teflon tubing **cannot be used**.

7.1.3.1 Enclosure Monitoring

The sampling inlet should be at some distance from the inner wall of the enclosure in order to ensure sampling representativeness. Typically, 30 centimeters (cm) or more is advisable. If there is any pressure difference between the interior of the enclosure and the location of the DataRAM 4, the exhaust port must be connected by tubing to the enclosure and, the air stream extracted from the enclosure must be returned after passing through the DataRAM 4. This measure will eliminate differential pressure issues.

7.1.3.2 Duct or Stack Sampling

The sampling probe inlet should face the direction of the airflow. If particles in the stream are larger than about 1 μm , such as soot particles, sampling should be under isokinetic conditions where the velocity of the air entering the sampling inlet should equal the air velocity in the duct/stack at that point. This can be achieved using the Isokinetic Sampling Kit which, in combination with the DataRAM 4 covering a range from 3 to 30 meters per second (m/s). The DataRAM 4 exhaust air stream should be returned to the duct/stack in order to ensure proper internal flow conditions within the instrument.

7.2 Operation

7.2.1 Set-Up Mode

All parameter and status changes must be performed while in the set-up mode. Once the DataRAM 4 is in the run mode, no changes can be made in the parameters or status of the instrument. While the DataRAM 4 is in the set-up mode the internal pump is not activated, except while zeroing. The instrument enters the Start-Up Mode as soon as the instrument is switched on. The user then has the choice to:



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- Wait before proceeding
- Zero the instrument and check its readiness
- Review or export previously logged data
- Edit data logging parameters
- Edit operating/measurement parameters

7.2.2 Run/Data Logging Mode

The Run Mode is the measurement/logging mode. The user can operate the DataRAM 4 in this mode either with or without data logging. While in the run mode, the user will be able to view all current measurement values, operating parameters, diagnostic status, as well as any logged values up to the present. While the DataRAM 4 is in the RUN mode the internal pump is always activated.

7.2.3 Start-Up

1. Make sure that the rear panel power switch is in the upward position.
2. Remove the sampling inlet protective cap by pulling up on the knurled metal outer piece and lifting it off.
3. Place the sampling inlet protective cap on the inlet storage post located on the rear panel of the instrument.
4. Press **ON** key for 2 seconds.
5. The documentation information screen appears after 5 seconds.

MIE	DataRAM 4
VER	35
S/N	D376
DEV#	1

6. Then display automatically changes.

MAIN MENU	
>	START RUN
>	ZERO/INITIALIZE
>	VIEW/TRANSFER DATA

7. From the MAIN MENU select ZERO/INITIALIZE.
8. Key **ENTER**.
9. The pump starts up and the following screen appears:



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```
ZEROING/INITIALIZING
COUNTDOWN: 194 sec
MEMORY LEFT: 100%
BATT. CHARGE 412 mA
```

10. A few seconds after the above display appears, the following screen appears:

```
ZEROING/INITIALIZING
COUNTDOWN: 186 sec
SOURCE 1: NORMAL
SOURCE 2: NORMAL
```

11. Then the following screen, indicating that the zeroing/initializing sequence has been completed:

```
ZEROING/INITIALIZING
READY!: 0 sec
SOURCE 1: NORMAL
SOURCE 2: NORMAL
```

7.2.4 Selecting Data Logging Parameters

1. Key **NEXT** from the MAIN MENU and the EDIT MENU is displayed.
2. The flashing cursor appears on the LOGGING PARAMETERS line.
3. Key **ENTER** to activate that function and display the following screen:

```
LOG DATA: DISABLED
LOG PERIOD: 00:00:05
TAG #: 13
AUTO START: DISABLED
```

4. Key **+** to toggle between **ENABLE** and **DISABLE** logging function.
5. Key **+** to **ENABLE**.
6. Key **▼** and the following screen is displayed:



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```
LOG DATA:  ENABLED
LOG PERIOD:  00:00:05
TAG #:       13
AUTO START:  DISABLED
```

7. Key the ▼ cursor to **LOG PERIOD**.
8. The cursor in this line indicates that logging period can be selected to any period between 1 second to 4 hours.
9. The value of the flashing digit can be changed up or down by keying + or -, respectively.
10. To change from one significant digit to another, key either ◀ or ▶.
11. Key the ▼ cursor to reach the TAG line (Run #).
12. Change/select as desired, or leave unchanged.

NOTE: The last line of the logging parameters allows for programming a specific start time and date for data logging.

NOTE: If the automatic start is disabled as shown in the above screen and logging has been enabled, then the logging of data starts as soon as a measurement run is initiated.

13. To start the logging at a later time or date, move the cursor to the last line and toggle + to enable the logging auto start function.
14. If this function is enabled, the following screen is displayed:

```
LOG DATA:  ENABLED
LOG PERIOD:  00:00:05
TAG #:       13
AUTO:       16:25 JAN 17
```

15. Desired time and date for the automatic start of logging can be selected as described previously.
16. To return to the EDIT MENU screen, key EXIT.

7.2.5 Selecting Set-Up Parameters

1. To select operating parameters key ▼ to select SETUP PARAMETERS on the EDIT MENU.
2. Key **ENTER** and the first of 4 set up parameters screen is displayed:



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DISPLAY AVG: 10 SEC
CAL FACTOR: 1.00
UNITS: (MASS) ug/m3
SIZE CORRECT: DISABL

3. Numerical values are changed by using the + and – keys, significant digits by using the ◀ and ▶ keys, and lines by using the ▼ and ▲ keys.
4. Units are changed by toggling or scrolling and enabling/disabling the relative humidity correction algorithm using the + and – keys.
5. The second set up screen is displayed by keying **NEXT**.

RH CORRECT: DISABL
TEMPERATURE UNITS: C
FLOW RATE: 2.00 LPM

- Enabled relative humidity correction compensates for the particle growth effect due to a high humidity environment.
 - The indicated temperature units can be selected between degrees Celsius (°C) and degrees Fahrenheit (°F).
 - The air sampling flow rate of the DataRAM 4 can be adjusted over the range of 1.00 to 3.00 liters per minute.
6. Key **NEXT** to view the following screen:

ANLG OUT: 4.00 mg/m3
SERIAL MODE: RS-232
DEVICE #: 124

- ANLG OUT refers to the full-scale variable value of the maximum analog output signal.
 - Selectable full-scale concentration ranges are: 0.1, 0.4, 1, 4, 10, 40, 100 and 400 mg/m³.
 - Selectable full-scale scattering coefficient ranges are: 10, 100, 1,000, 10,000 and 100,000 (Mm)⁻¹.
 - Visual range full scale value is fixed at 500 km.
 - RS-232 or RS-485 serial communications protocols are user selectable.
 - Device identification number is user selectable.
7. The next set up screen can be displayed by keying **NEXT**:



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16:49:11	10 May 2000
TIME	16:48:55
DATE	10 May 2000
TO SET PRESS => ENTER	

8. Set time and date if required by moving cursor to time or date line.
9. The value of the flashing digit can be changed up or down by keying + or -, respectively.
10. To change from one significant digit to another, key either ◀ or ▶.
11. At correct time or date setting press **ENTER**.
12. To display the next set up screen, key **NEXT**.

ALARM	ENABLED
LEVEL (ug/m3)	1000
AUTO ZERO	ENABLED
INTERVAL	48 hrs

13. The ALARM function is enabled or disabled by toggle of either + or – keys.
14. The Alarm Level is set in the units of micrograms per cubic meter and selected by toggle of either + or – keys.
15. Automatic Zero function is enabled or disabled by toggle of either + or – keys.
16. When the Automatic Zero function is enabled, the DataRAM 4 is automatically purged with particle-free air, registers the zero value, and then subtracts the optical background from all subsequent measurements.
17. The INTERVAL function allows for the selection of the time interval in hours between consecutive automatic zero activity.
18. To return to the MAIN MENU screen, key **EXIT**.

7.2.6 Run Start

1. From the MAIN MENU, select START RUN.
2. Key **ENTER**.
3. The following screen appears if concentration units were selected:

16:08:09	10 May 2000
CONC:	5.7 ug/m3
TWA:	11.0 ug/m3
RUN TIME:	00000:02:25

4. To view the other run parameters and diagnostic information, key **NEXT**.
5. The following screen appears if DataRAM 4 is being powered by its internal battery.



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MEMORY LEFT	87%
BATT. LEFT	76%
FLOW RATE	1.99 LPM
TEMP= 25.3C	RH= 59%

6. The following screen appears if DataRAM 4 is being powered by charger/power supply.

MEMORY LEFT	87%
BATT. CHARGE	326 mA
FLOW RATE	1.99 LPM
TEMP= 25.3C	RH= 59%

7. Key **NEXT** again and the following screen appears:

FLOW:	NORMAL
SOURCE 1:	NORMAL
SOURCE 2:	NORMAL
DETECTOR:	NORMAL

8. If any of the above functions or components is not operating correctly, the corresponding message will change from NORMAL to FAULT.
9. Key **NEXT** again and the following screen will be displayed:

SCATR PARAMETERS	
PAR SCAT RATIO	0.5133
ANGSTROM COEF:	2.336
PARTIC. DIA:	0.454 um

- PAR SCAT RATIO is the ratio of the scattering irradiances detected at the two internal source wavelengths for particle scattering alone.
- If scattering coefficient or visual range units have been selected, the second line will read TOT SCAT RATIO which means the ratio includes particle plus air Rayleigh scattering.
- The Ångström coefficient is the exponent that defines the wavelength-dependence of the scattering irradiance where the coefficient varies



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between 4 for pure Rayleigh scattering, and 0 for wavelength-independent geometric scattering.

7.2.7 Run Termination

1. To terminate a run, key **EXIT** and the following screen will then appear:

```
TERMINATE RUN ?  
  
TERMINATE:  => ENTER  
CANCEL:     =>  EXIT
```

2. To terminate run, key **ENTER** or to continue the current run, key **EXIT**.
3. If **ENTER** is keyed, the DataRAM 4 performs a purging operation for about 1 minute, and then displays the initial MAIN MENU screen from which a new run can then be started.
4. If during this purge cycle, the **OFF** key is pressed, the purging operation will continue while the following screen will appear indicating the countdown time in seconds for the completion of the purging cycle.
5. At the end of that purge period the DataRAM 4 shuts off automatically

```
TURN POWER OFF ?  
          PURGING:  39  
POWER OFF:  => ENTER  
CANCEL:     =>  EXIT
```

6. If **EXIT** is keyed while the above screen is displayed, the MAIN MENU screen will appear and remain after the purging has been completed.
7. If the **OFF** key is then pressed the DataRAM 4 will shut off without further purging since the instrument had already purged itself.

7.2.8 Review or Transfer Stored Data

1. To access stored data for viewing on the DataRAM 4 screen or for transfer to a PC, select the **VIEW/TRANSFERDATA** on the MAIN MENU.
2. Key **ENTER** and the following screen appears:



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```
TAG # 12
> VIEW LOGGED DATA
> TRANSFER TEXT FILE
> DELETE LOGGED DATA
```

3. To select the contents of a tag, select the appropriate number, using the + - ◀▶ key strokes.
4. To review the data logged for a selected tag #, key ▼ to select the VIEW LOGGED DATA line, then key **ENTER** and the following screen appears:

```
TAG # 12      43 POINTS
START  11:23  09 May 00
END    11:27  09 May 00
LOG PERIOD  00:00:06
```

- The screen above is one of two available tag summary screens.
 - The first line identifies the tag # and the number of data points logged during that run.
 - The second line provides the run start time and date.
 - The third line indicates the end time and date for that run.
 - The fourth line indicates the data logging period use during that run.
5. Keying **NEXT** displays the second tag summary screen:

```
TAG # 12      43 POINTS
AVG SCATR    0.00 1/Mm
MAX 207.33 11:23 09 May
AVG. DIA:    0.653 um
```

- The first line of the above screen repeats the information of the first tag summary screen.
 - The second line indicates the average measured value for that run.
 - This average is given in whatever units were selected originally on the first set-up screen.
 - The third line indicates the maximum registered instantaneous value in the same selected units, and the time and date when this maximum occurred.
 - The last line indicates the average volume median particle diameter in micrometers for that run.
6. To review the individual data points within a tag, key **NEXT** and the following screen is displayed:



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```
TAG # 12   POINT # 1
11:23:20 09 May 2000
171.46 1/Mm D = 0.40
um
TEMP 68.00 RH 40%
```

- The first line indicates the tag # and the point # within that run
- The second line is the time and date of that point
- The third line indicates the average measured value and the average volume median particle diameter for that logging period
- The last line indicates the corresponding temperature and relative humidity values.

7. Keying + advances the point # scrolling the screens through all data points within the selected tag # or run.
8. Keying **NEXT** returns the screen to the first tag summary table.
9. Keying **EXIT** returns the screen to the VIEW/TRANSFER DATA screen.
10. To delete logged data, select the DELETE LOGGED DATA line from the VIEW/TRANSFER DATA screen, and key **ENTER**.
11. The following screen appears:

```
DELETE LOGGED DATA
TAG # 01
> DELETE TAG DATA
> DELETE ALL DATA
```

12. Select either DELETE TAG DATA or DELETE ALL DATA, as preferred.
13. Key **ENTER**, and the following screen is displayed:

```
DELETING LOGGED DATA
TAG # 01
ENTER TO CONFIRM
EXIT TO CANCEL
```

14. To confirm the deletion command, key **ENTER**
15. To rescind the deletion command, key **EXIT**.
16. If **ENTER** is keyed, the following screen is displayed:



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TAG # 01
HAS BEEN DELETED
PRESS ANY KEY

17. The VIEW/TRANSFER DATA screen appears.



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8.0 CALCULATIONS

The DataRAM4 Particle Monitor is a direct reading instrument requiring no calculations.

9.0 QUALITY ASSURANCE/QUALITY CONTROL

9.1 General QA/QC Procedures

1. All data must be documented on field data sheets or in site logbooks.
2. The instrument must be operated (Appendix A) and maintained (Appendix B) according to the instructions supplied by the manufacturer, unless otherwise specified in the UFP-QAPP.
3. Instrument calibration and maintenance records are maintained by the Contractor's staff and are located in Edison, NJ and Las Vegas, NV.
4. Records must be maintained, documenting the training of the operators that use instrumentation and equipment for the collection of environmental information.

9.2 Annual Calibration

For mass concentration measurements, each DataRAM 4 is factory calibrated against a set of reference monitors that, in turn, are periodically calibrated against a gravimetric standard traceable to the National Institute of Standards and Testing (NIST).

The primary factory reference method consists of generating a dust aerosol by means of a fluidized bed generator. Injecting the dust continuously into a mixing chamber from which samples are extracted concurrently by two reference filter collectors, and two master real-time monitors.

The primary dust concentration reference value is obtained from the weight increase of the two filters due to the dust collected over a measured period of time at a constant and known flow rate. The two master real-time monitors are then adjusted to agree with the reference mass concentration value obtained from averaging the measurements of the two gravimetric filters to within $\pm 1\%$.

Three primary NIST traceable measurements are involved in the determination of the reference mass concentration: the weight increment from the dust collected on the filter, the sampling flow rate, and the sampling time. Additional conditions that must be met are: a) suspended dust concentration uniformity at all sampling inlets of the mixing chamber; b) identical sample transport configurations leading to reference and instrument under calibration; and c) essentially 100% collection efficiency of filters used for gravimetric reference for the particle size range of the test dust.

The test dust used for the factory calibration of the DataRAM 4 is SAE Fine (International Organization for Standardization [ISO] Fine) supplied by Powder Technology, Inc. It has the following physical characteristics as dispersed into the mixing chamber:

- Mass median aerodynamic particle diameter: 2 to 3 μm
- Geometric standard deviation of lognormal size distribution: 2.5
- Bulk density: 2.60 to 2.65 grams per cubic centimeter (g/cm^3)
- Refractive index: 1.54



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In addition to the mass calibration described above, the DataRAM 4 is factory calibrated using a gas with known scattering coefficient in order to adjust the relative scattering irradiance at the two source wavelengths.

10.0 DATA VALIDATION

The analyst will ensure that the particulate monitor was operated in accordance with this SOP, within instrument specifications (Appendix A) and all operational checks have been completed and are within the criterion specified in the site-specific UFP-QAPP. The Contractor's Task Leader (TL) is responsible for completing the UFP-QAPP verification checklist for each project.

11.0 HEALTH AND SAFETY

Based on Occupational Safety and Health Administration (OSHA) requirements, a site-specific health and safety plan (HASP) must be prepared for response operations under the Hazardous Waste Operations and Emergency Response (HAZWOPER) standard, [29 CFR 1910.120](#). Field personnel working for EPA's Environmental Response Team (ERT) should consult the Emergency Responder Health and Safety Manual currently located at <https://response.epa.gov/HealthSafetyManual/manual-index.htm> for the development of the HASP, required personal protective equipment (PPE) and respiratory protection.

Safety concerns specific to the operation of the DataRAM 4 include:

- Read and understand all instructions in this manual.
- Do not sample highly corrosive aerosols or solvent fumes.
- Do not attempt to disassemble the instrument.
- The DataRAM 4 should be operated only from the type of power sources described in this manual.
- Shut off DataRAM 4 and any external devices before connecting or disconnecting them.
- Shut off DataRAM 4 before plugging in or disconnecting the AC power supply.
- Never operate the DataRAM 4 without one of its internal filters in place.
- If the internal battery of the DataRAM 4 has been allowed to discharge completely, recharge the battery for at least 30 minutes before operating the DataRAM 4.
- During battery charging the DataRAM 4 should not rest on its front.

12.0 REFERENCES

Thermo Electron Corp., Environmental Instruments, 2003. *MODEL DR-4000 DataRAM 4 INSTRUCTION MANUAL*.

13.0 APPENDICES

- A – Specifications
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APPENDIX A

Specifications

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April 2020

(Source: Thermo Electron Corp. 2003. *MODEL DR-4000 DataRAM 4 INSTRUCTION MANUAL*)



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SPECIFICATIONS

Concentration measurement range (auto-ranging):

0.0001 to 400 mg/m³

Precision/repeatability (2-sigma):

± 1% of reading or ± 0.001 mg/m³, whichever is greater (1-second averaging)

± 0.3% of reading or ± 0.0003 mg/m³, whichever is greater (10-second averaging)

Accuracy:

± 2% of reading ± precision

Resolution:

0.1% of reading or 0.0001 mg/m³, whichever is greater

Scattering coefficient range:

10⁻⁷ to 0.4 m⁻¹ (resolution: 3 significant digits, max.)

Visual range:

0.01 to 337 km (@ λ = 550 nm) (resolution: 3 significant digits, max.)

0.02

Ångström coefficient measurement range:

0.0 to 4.0

Particle sizing range (log-normal, σ_g = 2.0, m = 1.50):

0.04 to 4.0 μm

Temperature measurement range:

-15 to 60 C° (accuracy: 0.5 C°)

Relative humidity measurement range:

0 to 100% (accuracy: 2%, non-condensing, @ 25 C°)

Sampling flow rate range:

1.0 to 3.0 liters/minute (accuracy: 0.05 liters/minute; adjustability: 0.1 liters/minute)

2.0

Measurement/display integration time range:

1 to 60 seconds (selectable in 1-second steps)

Measurement/display update frequency:

1/second

Alarm level adjustment range:

Selectable over entire measurement range for any of the selected measurement units (concentration, scattering coefficient or visual range)

Data logging averaging periods:

1 second to 24 hours (selectable in 1-second increments)

2



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Elapsed time readout range:

1 second to 100,000 hours (over 11 years), in seconds, minutes and hours

Digital communications:

RS232/RS485: full duplex, 9600 baud, software controlled, device filtered or 38400 baud with VIPER

Analog outputs:

0 to 5 V and 4 to 20 mA, with selectable full scale ranges between 0.1 and 400 mg/m³

Power:

- Internal battery: rechargeable sealed lead-acid, 7.2 Ah, 6 V, 20-hour run time between charges (typical)
- AC line: universal voltage charger/power supply (included), 100 – 250 V, 50 – 60 HZ (CE marked)
-

Alarm outputs:

- Alarm switch: 0 to +30 VDC (off, open), 2.5 A (on, closed)
- Alarm signal: 0 V (off), 5 V (on) (1 mA maximum load current)
- Audio alarm (back panel): > 60 dB @ 1 m

Operating environment:

-10 to 50 Co (14° to 122° F), 10 to 95% RH, non-condensing

Dimensions:

166 mm (6.54 in) H x 226 mm (8.90 in) W x 327 mm (12.87 in) D

Weight:

5.5 kg (12 lbs)



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APPENDIX B

Maintenance

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(Source: Thermo Electron Corp. 2003. *MODEL DR-4000 DataRAM 4 INSTRUCTION MANUAL*)



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MAINTENANCE SCHEDULE

Maintenance Required	Frequency	Performed
Return the DR-4000 to the factory for routine maintenance.	Annually	Authorized vendor personnel.
Cleaning the lenses in the sensing chamber.	BACKGROUND HIGH reading after Zeroing.	DR-4000 Operator
Replace the HEPA Filter cartridge	Following exposure to excessively high particulate levels.	DR-4000 Operator
Install an Analytic Filter.	When particulate samples are to be collected.	DR-4000 Operator
Periodic Maintenance	Monthly	DR-4000 Operator

General Guidelines

The DataRAM 4 is designed to be repaired at the factory. No user serviceable components are inside the metal enclosure of the DataRAM 4 with exception of the filter cartridge or the analytic filter holder. Access to the internal components of the unit by others than authorized personnel voids warranty. Unless a MALFUNCTION message is displayed, or other operational problems occur, the DataRAM 4 should be returned to the factory annually for routine check out, test, cleaning and calibration check.

Periodic Maintenance (Monthly)

1. Remove cap and turn unit **ON**.
2. Perform instrument **SELF TEST**.
 - a. After turning the unit on and unit is at the menu screen press **OFF** then the right arrow key (>) to **SELF TEST** and press ok.
 - b. The unit will go through a series of self-tests. Press **NEXT** each time an “OK” is displayed in the lower left hand corner of the display.
 - c. When the screen comes to the screen that displays “**Keys: 3 NEXTs to end**” press every key to test their functions. If all keys work, press the “**NEXT**” key 3 times to continue with self-test.
 - d. When testing is complete, you will come to a screen that will display “**TEST SUMMARY**” on the first line and either “**ALL PASSED**” or “**FAILURES**”
 - e. If the message is “**ALL PASSED**” the test is complete and you should press the “**NEXT**” button to finish the self-test and received and power down the instrument.
 - f. If you receive the message “**FAILURE**”, note the failure and try running a self-test again. If the unit fails again please contact the Thermo Electron Corporation Service Department.
3. Turn the unit back on, it will display “**resetting x-axis**” message.
4. Enter and wait for “**ZERO/INITIALIZE**” to complete.
5. Key **EXIT** and then enter “**VIEW/TRANSFER DATA**”. Then, “**DELETE LOGGED DATA**” and “**CLEAR ALL DATA**”. Exit to main menu.



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6. Enter **"LOGGING PARAMETERS"**. Set the following parameters.
 - a. **"LOG DATA"** to **"ENABLE"**
 - b. **"AUTOSTART"** to **"DISABLE"**
 - c. Exit to Menu
7. Enter **"SETUP PARAMETERS"**
 - a. Ensure date and time are set correctly.
 - b. Exit to menu.
8. Start Run and allow to run, ensuring that the **"L"** is present to show data logging is on. Run for at least 15 minutes.
9. At the end of the run clear data using step 5.

Battery Charging

If the DataRAM 4 is to be operated without its charger/power supply, the battery should be fully charged before initiating a run. In general, the user should maintain the battery charge as high as possible in order to extend its charge/discharge cycling capacity.

Instrument Storage

If the DataRAM 4 is to be stored for an extended period of time, place the 3-position switch on the back panel in its OFF position. Snap on quick-connect cap over the instrument inlet to protect the sensing optics from gradual dust contamination. Store DataRAM 4 in a dry environment.

Filter Replacement

To replace either of two types of filters used with DataRAM 4, place the instrument on its back rubber feet. On the bottom surface of the DataRAM, locate the large threaded plastic filter cover and holding the cross bar, rotate this cover counterclockwise. Remove cover and the filter holder within the open cavity.

HEPA Filter Cartridge Replacement

The DataRAM 4 is shipped from the factory with the HEPA filter cartridge installed. This cartridge can be identified by its metallic cover. Remove the filter cartridge as indicated in Filter Replacement Section above. Clean the internal black rubber gasket against which the cartridge is normally compressed. Install new HEPA-type cartridge by inserting its wider ridged end first. Reposition threaded plastic cover engaging threads carefully; rotate cover clockwise, hand tightening firmly. Properly dispose of used cartridge to prevent inadvertent re-use.

Analytic Filter Installation/Replacement

In order to install or replace the analytical filter holder, remove the HEPA cartridge normally in place, as described HEPA Filter Cartridge Replacement Section above. Remove the inlet cover of the Millipore plastic filter holder from the rest of that holder assembly containing the white membrane filter. Insert firmly the gray plastic adapter annulus into the open face of the filter holder assembly. Remove the red plastic plug from the exhaust nipple of the filter holder assembly. Ensure that all three components of the holder assembly are fully compressed to preclude any leakage. Insert the assembly into the filter cavity of the DataRAM 4 with the gray plastic adapter annulus bearing against the internal black gasket. Reposition threaded plastic cover and hand-tighten carefully and firmly. Set aside HEPA cartridge for future use.

In order to remove and/or to replace the membrane filter within its holder, remove the gray plastic adapter annulus and separate the two transparent plastic rings that compress the membrane filter. Make sure to remove and replace only the membrane filter using tweezers, leaving the white backing disc in the holder. A new membrane filter should then be placed over that backing and the sealing ring should then be inserted



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to trap and compress the filter and backing discs. For storage, the inlet cap with the blue plug should be inserted as well as the red plug on the back of the filter holder.

Cleaning of Optical Sensing Chamber

If the background level becomes excessive, the DataRAM 4 will alert the user at the completion of the zeroing sequence by the display of a BACKGROUND HIGH message. If this message is presented, the DataRAM 4 can continue to be operated providing accurate measurements. However, it is then advisable to clean the front surfaces of the optical lenses within the sensing chamber at the first convenient opportunity. The tools required for this cleaning are: an intense concentrated light source to view the inside of the sensing chamber, denatured alcohol, a soft lint-free cloth, and the special cleaning tool provided with the DataRAM 4 consisting of a cut-off cotton swab inserted in a plastic sleeve and held by a right-angle Allen wrench.

- Make sure to shut off power completely before proceeding with cleaning
- Install the stainless steel cover on the inlet of the DataRAM 4 to protect this fitting.
- Place the DataRAM 4 upside down on a table, resting the instrument on the inlet cover and the rear protective bumper.
- Unscrew the gray plastic cover of the filter cavity on the bottom surface of the DataRAM 4.
- Remove the filter cartridge from its cavity.
- Carefully clean the black soft filter-sealing gasket within the filter cavity by wiping it with the lint-free soft cloth. Use alcohol if necessary.
- Shine the concentrated light source into the sensing chamber located about 3 cm (1 1/4 in.) beyond the soft-sealing gasket in the filter cavity.
- Locate the three smaller side cavities inside the sensing chamber. These three cavities contain the lenses of the two sources and the common detector of the DataRAM 4.
- Wet the cotton swab of the lens-cleaning tool with alcohol.
- Holding the cleaning tool by its long handle, insert this tool into the sensing chamber without touching the walls of this chamber.
- Direct the cotton swab tip towards the opening of one of the three smaller cavities, and insert the cotton tip into this cavity as far as it will go.
- Gently wipe that internal surface touched by the swab tip by a rotating motion.
- Carefully withdraw the swab tip from the cavity.
- Repeat previous cleaning step for the other two small cavities.
- Carefully remove the cleaning tool from the sensing chamber. Allow the alcohol to dry leaving the filter cavity open for about 15 minutes.
- Re-insert the filter cartridge into its cavity and close it with its gray plastic cover, hand-tightening it firmly. Remove the inlet cap and store on its pod on the back panel.
- Place the DataRAM 4 right side up and key ON.
- Proceed to check its optical background by running the ZERO/INITIALIZE check. The message READY! should appear at the end of this check indicating that the lens contamination has been eliminated.
- Should the message BACKGROUND HIGH persist after completion of the above-described lens cleaning procedure, please contact the factory.



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APPENDIX C

Principle of Operation

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April 2020



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OPERATION OF DATARAM 4 PARTICULATE MONITOR

DataRam 4 Principle of Operation

The DataRAM 4 is a two-wavelength nephelometer utilizing active air sampling. The optical system incorporates two sources of illumination. One emits at a peak wavelength of 660 nanometers (nm) and the other at 880 nm. The beams of the light sources are collimated by corresponding lens systems and illuminate the same axial portion of the air flow duct.

The axes of the two source beams are angularly symmetrical with respect to the axis of a common detector that senses the light scattered by particles passing through the illumination beams. The two sources are alternatively activated at a frequency of 27 pulses per second, that is, only one source is activated at a time. The detector output signal is gated in synchronism with the alternating source pulses, providing two signal channels, one for each wavelength. The scattering angle for both source-detector combinations is centered on 60 degree ($^{\circ}$) $\pm 18^{\circ}$ with respect to the forward direction of the two beams.

After these two beams traverse the sensing region within the flow duct, they enter their respective light traps at the end of which there are corresponding reference detectors that sense the intensity of each of the illumination beams. Feedback circuits ensure that the light output of both sources remains constant.

The magnitude of the detected light scatter at either of the two wavelengths is directly proportional to the number and optical diameter of particles passing through the sensing region of the DataRAM 4, which is the volume of intersection between the illumination beams and the field of view of the common scattering detector. This response linearity, however, assumes that the optical properties of the particle population remain constant, that is, that particle size, shape distributions, and effective particle refractive index do not change appreciably. In practice however, and especially for the fine particle fraction, PM_{2.5}, in ambient environments, particle size can vary appreciably over time, and from site to site due to particulate emission and climatic changes. The effect of particle size changes on the scattering signal depends on the ratio of that size to the wavelength used to generate that scatter, and also on the breadth of the size distribution. However, using size dependence scattering and measurement of the ratio of the responses at two different wavelengths, it is possible to determine the particle size and correct the mass measurement. This capability has been incorporated in the DataRAM 4 and is intended to be applied to fine particle monitoring in combination with an inertial PM 2.5pre-collector. The PM 2.5pre-collector removes the coarse particle population larger than an aerodynamic diameter of 2.5 micrometers (μm) allowing measurement of only the fine particle fraction.



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OPERATION OF DRYCAL DEFENDER SERIES PRIMARY FLOW CALIBRATOR

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OPERATION OF DRYCAL DEFENDER SERIES PRIMARY FLOW CALIBRATOR

1.0 SCOPE AND APPLICATION

This standard operating procedure (SOP) describes the start-up, operation and routine use of the Bios International Corporation DryCal® Primary Flow Calibrator. The procedures and figures contained in this SOP are taken from the *DryCal® Manual* (2004) with the written consent (11/19/2015) of Bios International Corporation and Mesa Labs.

The DryCal Defender is a field portable primary flow calibrator that is used for industrial hygiene, environmental and laboratory measurement applications. The DryCal Defender is a National Institute of Standards and Technology (NIST) primary calibration standard that uses dry piston technology and infrared sensors to obtain volumetric flow rates. The DryCal Defender can be used to measure gas flow for either a vacuum flow source or a pressure flow source. Applications include precise calibration of secondary standard calibration equipment, such as rotameters, and industrial hygiene and environmental air sampling bags or pumps. Rapid calibrations are accomplished without the use of a soap solution thus reducing the uncertainty associated with other flow meters or rotameters.

A Quality Assurance Project Plan (QAPP) in Uniform Federal Policy (UFP) format describing the project objectives must be prepared prior to deploying for a sampling event. The sampler needs to ensure that the methods used are adequate to satisfy the data quality objectives listed in the UFP-QAPP for a particular site.

The procedures in this SOP may be varied or changed as required, dependent on site conditions, equipment limitations or other procedural limitations. In all instances, the procedures employed must be documented on a Field Change Form and attached to the UFP-QAPP. These changes must be documented in the final deliverable.

2.0 METHOD SUMMARY

The DryCal Defender is a primary flow standard. The time required for a graphite composite piston to traverse a known distance within a glass flow cell is precisely measured, and an internal computer calculates the flow. When a flow reading begins, an internal valve closes, diverting gas into the glass flow cell for measurement. The piston rises at the rate of gas flow between two collimated light beams at a known distance apart. After a suitable acceleration period, the rate of piston travel between the beams is timed. As the piston passes the second beam, the flow reading ends, the valve opens, the gas is released, and the piston drops. The volumetric flow measurement, based upon the parameters of length and time, is instantly displayed on the liquid crystal display (LCD) in milliliters per minute (mL/min) or liters per minute (LPM).

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

- Air samples require no preservation or special handling.
- DryCal Defender calibrators can remain on charge until needed without causing damage to the battery.
- If the calibrator is stored for long periods of time, the battery should be charged at least once every three months.
- Always store calibrators in a clean, dry environment with intake/exhaust valve caps on and recharge the unit prior to use after long-term storage.



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4.0 INTERFERENCES AND POTENTIAL PROBLEMS

- Flow reading error sources include:
 - When the DryCal Defender is used with pump models that pulsate (small shifts in flow rate during pulsation) the readings are affected accordingly.
 - Closure of the calibrator valve at the beginning of each flow reading results in a small pressure spike in the flow stream that can impact flow rate reading.
- Air containing cigarette smoke, excessive dust, or other particulates interferes with readings.
- Potential safety problems are presented in *Section 11.0 Health and Safety*.

5.0 EQUIPMENT/APPARATUS

The following equipment is provided for the operation and transport of the DryCal Defender Primary Flow Calibrator:

- DryCal Defender Flow Calibrator

Model	Optimum Flow Range ($\pm 1\%$)	Type/Type per Measurement
520L / 530L	5–500 mL/min	Single, Continuous, Burst /(1-15sec)
520M / 530M	50–5,000 mL/min	Single, Continuous, Burst /(1-15sec)
520H / 530H	300–30,000 mL/min	Single, Continuous, Burst /(1-15sec)

- Single-Station Battery Charger
- Tubing Kit
- Leak-test Accessory
- Additional High Flow Tubing with L, M, and H models
- Certificate of Calibration
- Instruction Manual

6.0 REAGENTS

This section is not applicable to this SOP.

7.0 PROCEDURES

7.1 Air Flow Train Setup

An isolation device is recommended to smooth the pulsation input and calibrator valve pressure spikes. To smooth flow, install a 25-millimeter (mm), 0.8-micrometer (μm) filter cassette in the flow train to create a suitable backpressure as needed.



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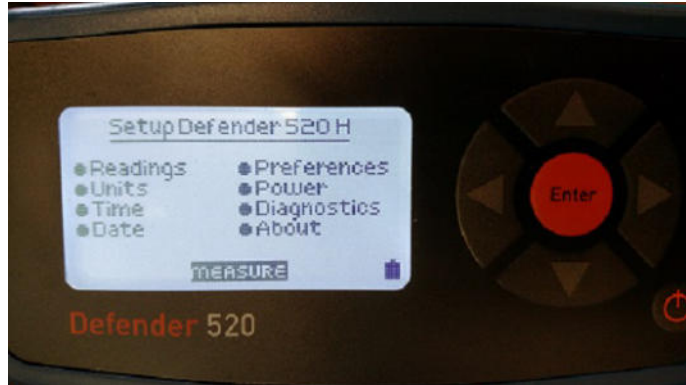
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7.2 Panel Buttons



7.3 Power ON

1. Press the **ON** button to turn the calibrator on.
2. An initializing screen will be displayed first showing the computer revision number then the standard flow display screen, choose **SETUP** to proceed.

Note: A Reset button is located on the lower back panel. If pressed, this button will quickly reset the unit to the initializing screen.

Note: The Defender has an “energy saving” 5 minute inactivity shut-off feature.

3. Press and hold the **POWER** button, choose the **ON/OFF** button then scroll down to **CONFIRM** setup.

7.4 Take Readings

7.4.1 Single Flow Reading

1. Connect tubing between the calibrator and the flow source with both instruments **ON**.

Note: The calibrator connecting air flow ports are located on the right side of the unit. The upper port is for suction (outlet) and the lower port is for pressure (inlet).



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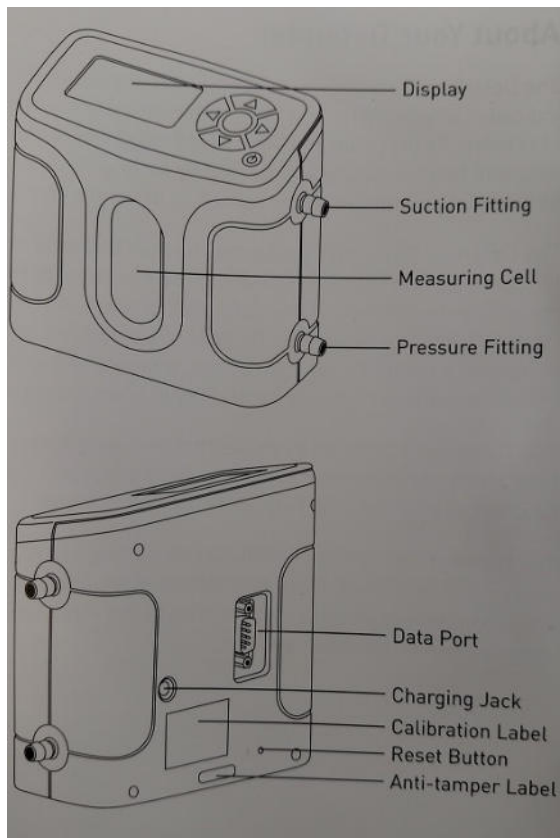
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Note: For industrial hygiene or environmental applications, the sampling medium should also be connected in-line.

2. Press the **READ** button **once** to obtain a single flow measurement display on the LCD screen.
3. A reading begins when the valve clicks shut, the white light-emitting diodes (LEDs) light, and the piston rises within the flow cell.
4. Continue the procedure to obtain the required number of flow readings.

Note: All successive readings in an averaging sequence will be used to calculate the average flow. The unit will automatically clear the average after ten readings and begin a new averaging sequence.

7.4.2 Continuous Mode Reading

1. From main menu choose **Preferences** > press **Enter**; under **Read Defaults** choose **"Single"**, **"Continuous"** or **"Burst"** and scroll down to Confirm setup.
2. To stop the continuous read session, press the **STOP** button once.



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The display will indicate the current flow reading (FLOW), the average flow value (AVERAGE) and the number of readings in the average (NUMBER IN AVERAGE) with a maximum of 10 readings as the average flow rate.

7.5 Stop and Reset

1. To stop a flow reading at any time, press and release **STOP** button.
2. To reset, press and hold the **STOP** button for two full seconds.
3. For a **Hard Reset** when the calibrator does not respond to push-button commands, press the recessed button on lower right side of the back panel near the parallel port.

8.0 CALCULATIONS

The DryCal Defender Primary Flow Calibrator is a direct reading instrument requiring no calculations.

The flow rate is calculated by the unit. The time required for a graphite composite piston to traverse a known distance within a glass flow cell is precisely measured, and an internal computer calculates the flow. The time the piston takes to move the known distance and implied volume yields the volumetric flow as:

$$q = \frac{v}{t} = \pi r^2 h / t$$

Where:

q = volumetric flow rate
 v = measurement volume
 t = measurement time
 r = radius
 h = measurement path length

9.0 QUALITY ASSURANCE/QUALITY CONTROL

9.1 General Quality Assurance/Quality Control Procedures

- All data must be documented on field data sheets or in site logbooks.
- The instrument must be operated according to this SOP and the operating instructions supplied by the manufacturer, unless otherwise specified in the UFP- QAPP.
- Consult *Appendix B* Maintenance Records “Blue Book” (Quarterly Defender Bios Calibrator) for quarterly maintenance procedures.
- Records must be maintained, documenting the level of competency for the Contractor’s personnel who will operate the instrument.

9.2 Annual Calibration

The DryCal Defender must be calibrated annually by an accredited vendor.



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10.0 DATA VALIDATION

The operator will ensure that the DryCal® Defender Primary Flow Calibrator was operated in accordance with this SOP within instrument specifications and all operational checks have been completed and are within the criteria specified in the site-specific UFP-QAPP. The contractor's Task Leader is responsible for completing the UFP-QAPP verification checklist for each project.

11.0 HEALTH AND SAFETY

Based on Occupational Safety and Health Administration (OSHA) requirements, a site-specific health and safety plan (HASP) must be prepared for response operations under the Hazardous Waste Operations and Emergency Response (HAZWOPER) standard, [29 CFR 1910.120](#). Field personnel working for EPA's Environmental Response Team (ERT) should consult the Emergency Responder Health and Safety Manual currently located at <https://response.epa.gov/HealthSafetyManual/manual-index.htm> for the development of the HASP, required personal protective equipment (PPE) and respiratory protection.

Safety concerns specific to the operation of the DryCal Defender include:

- The DryCal Defender is not rated intrinsically safe and is not for use with explosive gases or for use in explosive environments.
- The Defender is not designed for pressurization above 0.35 bar (5 pounds per square inch [PSI]) or gas flows above the rated specifications of the flow cell in use. Consult *Appendix A: Specifications* for acceptable gas flow ranges.
- Use only with clean laboratory air or other inert, non-corrosive gases only.

12.0 REFERENCES

Mesa Laboratories, Inc. 2017. *Defender™ 500 Series User Manual (MK01-24 REV F)*.
Mesa Laboratories, Inc. 2016. *Defender™ 530+ User Manual (MK01-51 REV A)*.

13.0 APPENDICES

A - Specifications
B – Quarterly Maintenance Procedures



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APPENDIX A

Specifications

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January 2020

(Source: Bios International Corporation. - 2004. *DryCal® Defender Manual*)



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OPERATION OF DRYCAL DEFENDER SERIES PRIMARY FLOW CALIBRATOR

Defender 500 Series Specifications

Models:

510L/520L, from 5-500 mL/min

510M/520M, from 50-5,000 mL/min

510H/520H, from 300-30,000 mL/min

Measurements:

Volumetric Accuracy: $\pm 1\%$ of reading

Time per Measurement: 1-15 seconds (approximate)

Type: Single, Continuous or Burst

Volumetric Flow Units: cc/min, mL/min, L/min, cf/min

Pressure Units (Defender 520): mmHg, PSI, kPa

Temperature Units (Defender 520): °C, °F

Basics:

Dimensions (H x W x D): 5.5 x 6 x 3 in / 140 x 150 x 75 mm

Weight: 29 oz / 820 g

Configuration: Integrated flow measuring cell,
valve and timing mechanism

Temperature & Pressure Sensors (Defender 520 model only):

In the flow stream

Press.: 3.5 mmHg (typical), 7.0 mm (max);

Temp.: 0.8° C (typical), 1.3° C (max)

AC Adapter/Charger: 12V DC, >250ma, 2.5 mm,
center positive

Battery: 6V rechargeable, sealed lead-acid,
6-8 hours typical operation



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Battery Operational Time (5 cycles/min):

3 hrs backlight on, 8 hrs backlight off

Pressure & Suction Fittings: 1/4" barbed tube fittings

Display: Backlit graphical LCD

Usage:

Flow Modes: Suction or Pressure

Operating Pressure (Absolute): 15 PSI

Operating Temperature: 0-50° C

Ambient Humidity: 0-70%, non-condensing

Storage Temperature: 0-70 °C

Warranty: 1 year; battery 6 months

Bios Optimizer Software

Requires Windows XP-SP2 or Windows 2000-SP3 compatible PC and RS-232 (serial) connection

Bios Optimizer 110 installation CD (supplied);
no restrictions apply

RS-232 cable (supplied) for Defender 500 Series data port to
PC RS-232 (serial) port connection

PC Card (optional and as necessary) creates an RS-232 port
on your PC

Licensed upgrade to Bios Optimizer 120 is available



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OPERATION OF DRYCAL DEFENDER SERIES PRIMARY FLOW CALIBRATOR

7.0 Defender 530+ Series Specifications

Technical data about your Defender 530+

Models:

530+ L, from 5-500 cc/min

530+ M, from 50-5,000 cc/min

530+ H, from 300-30,000 cc/min

Measurements:

Standardized Accuracy: $\pm 1\%$ of reading

Volumetric Accuracy: $\pm 0.75\%$ of reading

Time per Measurement: 1-15 seconds (approximate)

Type: Single, Continuous or Burst

Volumetric Flow Units: cc/min, mL/min, L/min, cf/min

Standardized Flow Units: scc/min, smL/min, sL/min, scf/min

Pressure Units (Defender 530+): mmHg, PSI, kPa

Temperature Units (Defender 530+): °C, °F

Basics:

Dimensions (H x W x D): 5.5 x 6 x 3 in / 140 x 150 x 75 mm

Weight: 29 oz / 820 g

Configuration: Integrated flow measuring cell, valve and timing mechanism

Temperature & Pressure Sensors: In the flow stream

Press Accuracy: 3.5 mmHg (typical), 7.0 mm (max);

Temp Accuracy: 0.8° C (typical), 1.3° C (max)

AC Power Adapter/Charger: 12VDC, >250ma, 2.5 mm, center positive

Battery: 6V rechargeable, sealed lead-acid, 6-8 hours typical operation



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Battery Operational Time (5 cycles/min): 3 hrs backlight on, 8 hrs backlight off
Pressure & Suction Fittings: 1/4" ID Swagelock® fittings for Low and Medium models, 3/8" ID for High model
Display: Backlit graphical LCD

Usage:

Flow Modes: Suction or Pressure

Operating Pressure (Absolute): 15 PSI

Operating Temperature: 0-50°C

Ambient Humidity: 0-70%, non-condensing

Storage Temperature: 0-70°C

Warranty: 1 year; battery 6 months

DryCal Pro Software:

DryCal Pro Software System Requirements

- Windows® XP, Windows® 7
- Microsoft Excel® 2003 and up
- RS-232 port, or if your PC does not have an RS-232 port you will need a USB to RS-232 adapter



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APPENDIX B

Quarterly Maintenance Procedures

SOP: ERT-PROC-2130-20

January 2020

(Source: "Quarterly Defender Bios Calibrator")



STANDARD OPERATING PROCEDURES

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OPERATION OF DRYCAL DEFENDER SERIES PRIMARY FLOW CALIBRATOR

Name: _____

Date: _____

Prior to verification of each Unit check if below parameters are set correctly.

Connect SKC pump via Tygon® tubing to "Suction Port" of the Defender unit.

"Setup Readings" (Press Enter) > "No. in Avg": 010 / "Time Between": 00 / "Type": Vol > Press Confirm & Exit

"Setup Units" (Press Enter) > "ml/min/Pressure": mmHg / "Temp": F > Press Confirm & Exit

Setup "Time and Date" following Menu as above.

"Preferences" (Press Enter) > "Read Default": Continuous / "Default Settings": No / "Data Port": BIOS / "Magnification": Detail > Press Confirm & Exit; now the Unit is ready for flow verification readings in ml/min.

Back to main menu and press "Measure" > "Continuous" = Record readings under "Readings ±1%"

Pass = Volumetric count functioning properly. Fail = Unit/Display/Counter not working; specify in comments.

Model Type	Volumetric Range	Unit S/N	Last Cal. Date	Cal. Due Date	Pass	Fail	Comments
Defender 520-L	5 - 500ml/min	111952					
Defender 520-L	5 - 500ml/min	111953					
Defender 530-L	5 - 500ml/min	136257					
Defender 530-L	5 - 500ml/min	136258					
Defender 520-M	50 - 500ml/min	111888					
Defender 520-M	50 - 500ml/min	111889					
Defender 530-M	50 - 500ml/min	136224					
Defender 530-M	50 - 500ml/min	136225					
Defender 520-H	300 - 30000ml/min	111511					
Defender 520-H	300 - 30000ml/min	111512					
Defender 530-H	300 - 30000ml/min	136060					
Defender 530-H	300 - 30000ml/min	136061					

8. A schedule in accordance with section 5.7.

9. A description of institutional controls to be implemented. Where the remedial party is not the owner of the site on which the institutional control will be placed, the work plan must include a written agreement from the property owner committing to the necessary environmental easement or deed restriction prior to the design completion.

10. A requirement to submit a SMP in accordance with section 6, including a schedule for the submission of the final plan, taking into account the items identified in paragraph 5.2(b)7.

11. Drawings and figures, as needed, to define the elements of the remedial construction in satisfaction of paragraphs 1 through 6 above.

(c) The remedial design should incorporate provisions for the preparation, at the completion of the remedial action, of a set of “as-built” drawings, in addition to a construction completion or FER, as set forth in section 5.8 in accordance with subdivision 5.2(b).

(d) Electronic submissions. The RAWP and any required reports and/or documentation identified by this section must be provided in an electronic format in accordance with section 1.15.

5.4 Remedial Action Implementation Compliance

(a) Compliance with community air monitoring plan (CAMP), dust monitoring or other controls identified by the CERP, if required for the remedial action. The approved CAMP and the fugitive dust/particulate monitoring program, which is a component of the CAMP, are critical elements in the evaluation of RA compliance.

1. Guidance for monitoring compliance of:

- i. the CAMP is provided in Appendix 1A; and
- ii. the fugitive dust/particulate monitoring plan is provided in Appendix 1B.

2. The monitoring data gathered by the implementation of these plans is to be provided to DER on a regular basis. The frequency is identified in the approved construction schedule and/or RAMP prepared in accordance with subdivision 4.1(e). Real time or web based reporting may be required by DER on a case-by case basis.

3. Any monitoring results which exceed the action levels set by the CAMP are to be:

- i. reported, or notice provided by another arrangement acceptable to DER:

- (1) when identified, when a DER representative is present at the site; or
- (2) within two hours by phone call or e-mail, to DER project manager when no DER representative is on the site; and

ii. summarized in a weekly, or other period identified by DER, CAMP report, including the duration and actions taken in response to any such exceedance. A template of the CAMP

report is available on DEC's website identified in the table of contents.

4. If applicable for the remedial action, a report on any other controls identified by a CERP.

(b) Compliance with site-specific soil cleanup levels. Evidence of compliance with a remedy=s achievement of the soil cleanup levels identified for the site will be through the collection and analysis of compliance samples during the implementation of the remedy. These compliance samples, either documentation or confirmation samples, are discussed in paragraphs 1 and 2 below and are determined based upon the endpoint defined for the remedial action by the decision document.

1. Documentation samples, as defined in paragraph 1.3(b)12, are generally required by a site remedy when the soil cleanup is based on (an) excavation(s) to pre-specified excavation limits described in the remedy decision document and delineated during remedial design. Documentation samples are collected and analyzed to document the soil levels achieved by the remedy.

2. Confirmation samples, as defined in paragraph 1.3(b)3, are required when the limits of soil removal are to be determined by achieving a soil cleanup level in the field. Confirmation samples are to demonstrate that the remedy has achieved the soil cleanup levels identified by the decision document, determined as follows:

- i. the use of averages, means or other statistical techniques are generally not allowed, however, recognizing the heterogeneity of contaminated sites and the uncertainty of sampling and analysis of samples, the DER project manager may judge that remediation is complete for sites when:

- (1) there is a large number of confirmatory samples;
 - (2) the vast majority of confirmation samples indicate that the soil cleanup levels for the site have been achieved; and
 - (3) those that do not achieve the SCO exceed it only by a small amount; and

- ii. should the remedial party disagree with the professional judgment of the DER project manager, the remedial party may submit a justification that there is a 95% confidence level that the soil cleanup levels have been achieved using the procedure defined in the EPA guidance document *Supplemental Guidance to RAGS: Calculating the Concentration Term. USEPA Publication 9285.7-081* (May 1992). DER will evaluate this information and make a determination whether the sampling adequately documents that the objectives have been achieved.

3. All sample collection should be in accordance with sections 3.2 through 3.5.

4. All sample analysis and the reported results should be consistent with sections 2.1 through 2.3.

5. The following are minimum confirmation sampling frequencies for soil excavations of:

- i. less than 20 feet in perimeter, include one bottom sample and one sidewall sample biased in the direction of surface runoff;

- ii. 20 to 300 feet in perimeter, where the remedy is seeking to achieve:

- (1) surface soil levels, one sample from the top of each sidewall for every 30

linear feet of sidewall and one sample from the excavation bottom for every 900 square feet of bottom area; and

(2) subsurface soil cleanup levels, one sample from the bottom of each sidewall for every 30 linear feet of sidewall and one sample from the excavation bottom for every 900 square feet of bottom area;

iii. greater than 300 feet in perimeter, should be in accordance with either:

(1) subparagraph ii above; or

(2) a DER-approved reduced sampling frequency, where the remedial party submits a proposed sampling frequency, with supporting rationale, in accordance with section 1.6;

iv. in an excavation where multiple layers of contamination have been visually or analytically identified, additional side wall samples in the horizon in which contamination was identified are necessary;

v. each excavation within a larger excavation will be considered a separate excavation and should comply with subparagraphs i through iii above; and

vi. for side or bottom samples, for volatile organic compounds in an excavation:

(1) within 24 hours of excavation, they should be taken from the zero to six-inch interval at the excavation floor; or

(2) after 24 hours, the samples should be taken at six to twelve inches; and

vii. no water should be present in the excavation bottom where bottom samples are collected.

6. For tank excavations. When tanks are excavated, if contaminated soil is removed, confirmation soil samples for laboratory analysis should be taken:

i. immediately after contaminated soil removal, pursuant to paragraph 5.4(b)5; and

ii. if the excavation is enlarged horizontally beyond the immediate tank removal area, additional soil samples will be taken pursuant to paragraph 5.4(b)2 or in accordance with subdivision 5.5(c) when a site characterization in accordance with subdivision 3.1(a) is determined necessary by this subdivision.

7. Confirmation and/or documentation sample locations and depth should be biased toward the:

i. areas and depths of highest contamination identified during previous sampling episodes unless field indicators such as field instrument measurements or visual contamination identified during the remedial action indicate that other locations and depths may be more heavily contaminated; and

ii. locations and depths of the highest expected contamination.

(c) Compliance for in-situ treatment technologies. A sampling program should be undertaken for sites where an *in situ* remediation technology is a component of the remedial program.

1. The work plan for the sampling program is to be approved by DER and is to be consistent with the investigation work plan requirements of section 3.3 and the applicable media specific requirements of the sections 3.5, 3.7 or 3.8.

2. The sampling program must:

- i. determine whether the design parameters of the treatment system are being achieved;
- ii. determine whether any discharges are compliant with identified permit or exempted permit, limits established for the site; and/or
- iii. document the effectiveness of the system, in accordance with subdivision 6.2.2 (c).

(d) Compliance with site restoration activities. All areas of the site or adjacent areas which are disturbed or otherwise used during implementation of the remedial program should be subject to the site restoration requirements of the site decision document or approved remedial design/RAWP.

1. Site restoration should include:

- i. restoring the site and/or adjacent areas to pre-remediation conditions with respect to topography, hydrology and vegetation, to the extent practicable;
- ii. restoration related to an approved development plan for the site (e.g., increasing soil cover depth to account for a 100 year flood elevation); or
- iii. where development is planned and a final restoration has not been identified or approved, the RD or RAWP will provide for, at a minimum, restoration sufficient to ensure the effectiveness and compliance with the remedial program.

2. It should be noted that some site restoration measures for remedial activities within or adjacent to wetlands, flood plains or other environmentally sensitive areas may have further requirements under the following DEC regulations (e.g., 6 NYCRR Parts 182, 500-502, 608, 661 & 663).

3. Where site restoration calls for the abandonment of monitoring, recovery, injection or other wells installed as part of the remedial program, the decommissioning should be approved by DER and performed in accordance with DEC guidance, e.g. CP-43 *Commissioner's Policy on Groundwater Monitoring Well Decommissioning*, available on DEC's website identified in the table of contents.

(e) Compliance for soil which exists at or is imported to a site. Soil which exists at, or is imported to, a site which is used to construct a soil cover, site cap system or as excavation backfill must meet the requirements of 6 NYCRR 375-6.7(d) and;

1. Soil imported to a site for use in a soil cap, soil cover or as backfill will:

- i. comply with any RAOs which may be identified for a soil cover or the soil comprising a cap, by a remedy selected pursuant to Chapter 4.

- ii. be free of extraneous debris or solid waste;
- iii. be recognizable soil or other unregulated material as set forth in 6 NYCRR Part 360 and materials for which DEC has issued a beneficial use determination, which comply with the requirements of paragraph 2 below;
- iv. not exceed the allowable constituent levels for imported fill or soil as described in paragraph 2 below, unless a site-specific exemption is provided by DER in accordance with paragraph 8 below; and
- v. be tested as described in paragraph 3 below.

2. The fill material should not exceed the allowable constituent levels for imported fill or soil for the use of the site which are provided in Appendix 5, taking consideration that where the protection of ecological resources SCO is required for the site, the protection of ecological resources SCO must also be considered in selecting the lowest of the applicable SCGs. Where a compound is detected which is not on the Appendix 5 table the remedial party should:

- i. determine if the constituent of concern is included on the supplemental soil cleanup objective tables in CP-Soil and if so use the CP-Soil values as the allowable constituent level; or
- ii. consult with DER to determine an allowable constituent level.

3. Sampling is required for all imported soil for use as backfill or cover material. Sampling frequency of the material will be determined by the remedial design or remedial action work plan:

- i. considering Table 5.4(e)10 and paragraph 10 below, and sampling will be performed consistent with sections 2.1 through 2.3;

- ii. with a minimum one sample analyzed from every new source, at the following sampling frequency for:

- (1) soil or sand imported from a virgin mine/pit, at least one round of characterization samples for the initial 100 cubic yards of material, in accordance with Table 5.4(e)10 below;

- (2) material sources other than a virgin mine/pit (e.g., a former manufacturing site), in accordance with Table 5.4(e)10; or

- (3) sites where large amounts of cover material/backfill are required, the sampling frequency can be reduced from that specified in Table 5.4(e)10 once a trend of compliance is established; and

- iii. the DER project manager may modify the number of samples required by subparagraph ii above based on the site being remediated and the source of the material, in accordance with the modification provisions set forth in section 1.6.

4. Reuse of soil from the site. Soil originating on the site may be reused on the site or exported for reuse provided sampling demonstrates compliance with SCGs as detailed in Table 5.4(e)4. Soil which is not going off-site for reuse will be disposed in a permitted treatment, storage or disposal facility, unless paragraph 10 below provides for such export.

Table 5.4(e)4 Reuse of Soil [for Paragraph 5.4(e)4]		
Soil on the Site Meets:	Reuse on the Site:	Off-site Export & Reuse:
Unrestricted Soil SCGs	Without restrictions	Without restrictions
Meets the Applicable Use-based and Groundwater Protection SCG and where Appropriate Protection of Ecological Resources Soil SCGs for a Site w/ an IC & SMP.	In the soil cover/cap or as backfill within the area of the site subject to the IC.	Not Allowed, unless going to a site with IC subject to a 6 NYCRR Part 360 Beneficial Use Determination (BUD).
Meets Site-Specific Background Soil Levels.	Without restrictions. (Does not apply to sites in the BCP.)	Not Allowed, unless going to a site with IC subject to a 6 NYCRR Part 360 BUD.
Site-specific cleanup goals for subsurface soil	Placement below the soil cover/cap within the area of the site subject to the IC.	Not Allowed, unless going to a site with IC subject to a 6 NYCRR Part 360 BUD.

5. Material other than soil imported to a site. The following material may be imported, without chemical testing, to be used as backfill beneath pavement, buildings or as part of the final site cover, provided that it contains less than 10% by weight material which would pass through a size 80 sieve and consists of:

- i. gravel, rock or stone, consisting of virgin material from a permitted mine or quarry;
- or
- ii. recycled concrete or brick from a DEC registered construction and demolition debris processing facility if the material conforms to the requirements of Section 304 of the New York State Department of Transportation *Standard Specifications Construction and Materials Volume 1* (2002).

6. The remedial party must provide documentation of the source of fill to DER for approval of the source of the material before it is used on the site, which should include:

- i. the name of the person providing the documentation and relationship to the source of the fill;
- ii. the location where the fill was obtained;
- iii. identification of any state or local approvals as a fill source; and
- iv. if no prior approval is available for the source, a brief history of the use of the property which is the source of the fill.

7. Bills of lading should be provided to DER to document that the fill delivered was from a DER-approved source(s).

8. For all remedial programs except those developed pursuant to the BCP, DEC may issue a

site-specific exemption for one or more of the requirements set forth in this section, based upon site-specific conditions, such as:

- i. use and redevelopment of the site;
- ii. depth of the placement of the backfill material relative to the surface or subsurface structures;
- iii. depth of the placement of the backfill material relative to groundwater;
- iv. volume of backfill material;
- v. potential for odor from the backfill material;
- vi. presence of historic fill in the vicinity of the site;
- vii. DEC-issued beneficial use determination, pursuant to 6 NYCRR Part 360; or
- viii. background levels of contamination in areas surrounding the site.

9. For remedial programs pursuant to the BCP, DEC can only provide a site-specific exemption for backfill consistent with the provisions of paragraph 8 above as follows:

- i. for Track 2 and Track 3 cleanups, for soils greater than 15 feet below ground surface; or
- ii. for Track 4 cleanups, for soils beneath buildings, pavement and other improvements or for soils beneath the soil cover system or soil cap over exposed surface soils.

10. Sampling fill imported to or exported from a site. The remedial party will sample and analyze the fill being imported to the site in accordance with this subdivision and Table 5.4(e)10. Samples of the fill will be collected based on the soil quantity and type of constituents identified in the table and will be a combination of discrete and composite samples, handled as follows:

- i. for VOCs only, grab samples are allowed. These grab samples are one or more discrete samples taken from the fill, with the number as specified in the volatile column of Table 5.4(e)10 for the soil quantity in question, and analyzed for the VOCs identified in Appendix 5; or
- ii. for SVOCs, inorganics and PCBs/pesticides:
 - (1) one or more composite samples are collected from the volume of soil identified in Table 5.4(e)10 for analysis, with each composite from a different location in the fill volume;
 - (2) each composite is prepared by collecting discrete samples from 3 to 5 random locations from the volume of soil to be tested; and
 - (3) the discrete samples are mixed, and after mixing, a sample of the mixture is analyzed for the SVOCs, inorganic and PCBs/pesticide constituents identified in Appendix 5.

Table 5.4(e)10			
Recommended Number of Soil Samples for Soil Imported To or Exported From a Site			
Contaminant	VOCs	SVOCs, Inorganics & PCBs/Pesticides	
Soil Quantity (cubic yards)	Discrete Samples	Composite	Discrete Samples/Composite
0-50	1	1	3-5 discrete samples from different locations in the fill being provided will comprise a composite sample for analysis
50-100	2	1	
100-200	3	1	
200-300	4	1	
300-400	4	2	
400-500	5	2	
500-800	6	2	
800-1000	7	2	
➤ 1000	Add an additional 2 VOC and 1 composite for each additional 1000 Cubic yards or consult with DER		

(f) Compliance for soil exported from a site for reuse. For soil that is being exported from a site to locations other than permitted disposal facilities, the handling requirements are set forth in this subdivision and in paragraph 5.4(e)4.

1. Levels of contamination must not exceed the lower of the groundwater and residential use levels as shown in Appendix 5, absent a beneficial use determination issued by DEC. DER will coordinate with the Division of Solid & Hazardous Materials (DSHM), prior to the start of the remedial action, relative to whether the exported soil can be used beneficially in accordance with 6 NYCRR 360-1. The sampling and analysis requirements are set forth in paragraph 5.4(e)10.

2. The number of required samples are specified in Table 5.4(e)10 and paragraph (e)10 above, which may be modified by the DER project manager based on various factors, including the location of the site receiving the soil.

(g) Compliance for the decommissioning of monitoring wells. All monitoring wells not required for site management should be decommissioned in accordance with paragraph (d)6 above prior to DER approval of the FER.

5.5 Underground Storage Tank Closure

(a) The first step for underground storage tank (UST) closure is the identification, removal, treatment, containment and/or stabilization of the contents to prevent contaminant exposure to receptors and to prevent further movement of contaminants through any pathway as set forth herein.

1. A health and safety plan for the site is developed, as described in section 1.9, by a qualified individual in accordance with subparagraph 1.5(a)3.i.

2. Underground tank closures not performed in accordance with this section will require a certification of the closure report by a professional engineer, as described in section 1.5.

FIELD SAMPLING PROTOCOLS TO AVOID CROSS-CONTAMINATION AT PERFLUORINATED CHEMICAL (PFC) SITES

The following are procedures/considerations to be made during field activities at potential perfluorinated chemical (PFC) release sites. A summary of the prohibited and acceptable items for PFC sites is included in Table 1. A checklist for field use is provided as Attachment 1.

These procedures apply to all personnel and subcontractors who collect or otherwise handle samples of soil, sediment, surface water, ground water, or drinking water for analysis of PFCs. These procedures should be reviewed by all on-site personnel prior to implementation of field activities. Given the low detection limits associated with PFC analysis and the many potential sources of trace levels of PFCs, field personnel shall act on the side of caution by strictly following these protocols, frequently replacing nitrile gloves, and rinsing field equipment to help mitigate the potential for false detections of PFCs. Specific items related to field sampling are discussed below.

Field Equipment

- ☐ **Do not use Teflon®-containing materials** (e.g., Teflon® tubing, bailers, tape, plumbing paste, or other Teflon® materials) since Teflon® contains fluorinated compounds.
- ☐ **Do not use low-density polyethylene (LDPE) materials** during sampling. High-density polyethylene (HDPE) and silicon materials are acceptable.
- ☐ When using liners to collect soil samples during direct-push technology (DPT) or conventional drilling methodologies, **acetate liners are to be used.**
- ☐ To avoid plastic coating or glue materials, **do not use waterproof field books.** Field reports will be documented on loose paper on masonite or aluminum clipboards (i.e. plastic clipboards, binders, or spiral hard cover notebooks are not acceptable) using a pen or pencil. Sharpies®/markers may be used.
- ☐ **Post-It Notes are not allowed** on project sites.
- ☐ **Do not use markers other than Sharpies® markers.** Pens will be used when documenting field activities in the field log and on field forms as well as labeling sample containers and preparing the Chain of Custody.
- ☐ **Do not use chemical (blue) ice packs** during the sampling program. This includes the use of ice packs for the storage of food and/or samples.

Field Clothing and Personal Protective Equipment

- ☐ **Do not wear synthetic water resistant, waterproof, or stain-treated clothing** during the field program. Field clothing to be worn on-site should be restricted to natural fibers (preferably cotton) and not synthetic. Field clothing should be laundered avoiding the

use of fabric softener. Preferably, field gear should be cotton construction and well laundered (a minimum of 6 times from time of purchase). New cotton clothing may contain PFC related treatments. **Do not use new clothing** while sampling or sample handling.

- ☐ **Do not wear clothing or boots containing Gore-Tex™** during the sampling program as it consists of a PFC membrane.
- ☐ All safety footwear will consist of steel-toed boots made with polyurethane and polyvinyl chloride (PVC).
- ☐ **Do not wear Tyvek® clothing** on-site since it contains fluorinated compounds.
- ☐ Disposable nitrile gloves must be worn at all times. Further, a new pair of nitrile gloves shall be donned prior to the following activities at each sample location:
 - Decontamination of re-usable sampling equipment;
 - Prior to contact with sample bottles or water containers;
 - Handling of any quality assurance/quality control samples including field blanks and equipment blanks; and,
 - After the handling of any non-dedicated sampling equipment, contact with non-decontaminated surfaces, or when judged necessary by field personnel.

Sample Containers

- ☐ Different laboratories may supply sample collection containers of varying sizes dependent on the type of media to be sampled (e.g., soil, groundwater, etc.). However, all samples should be collected in polypropylene or HDPE bottles fitted with an unlined (no Teflon®), polypropylene or HDPE screw cap.
- ☐ Container labels will be completed using pen after the caps have been placed back on each bottle.
- ☐ Glass containers should also be avoided due to potential loss of analyte through adsorption.

Wet Weather

- ☐ Field sampling occurring during wet weather (e.g., rainfall and snowfall) should be conducted while wearing appropriate clothing that will not pose a risk for cross-contamination. Teams will avoid synthetic gear that has been treated with water-repellant finishes containing PFCs. Use rain gear made from polyurethane and wax-coated materials.
- ☐ Teams should consider the use of a gazebo tent, which can be erected over the sample location and provide shelter from the rain. It should be noted that the canopy material is likely a treated surface and should be treated as such; therefore, gloves should be worn when moving the tent, changed immediately afterwards and further contact with the tent

should be avoided until all sampling activities have been finished and the team is ready to move on to the next sample location.

Equipment Decontamination

Field sampling equipment, such as trowels and augers, that are utilized at each sample location will require cleaning between uses. Alconox® and Liquinox® soaps are acceptable for use since the Material Safety Data Sheets do not list fluoro-surfactants as an ingredient. However, **Decon 90 will not be used** during decontamination activities. Water used for the final rinse during decontamination of sampling equipment will be laboratory certified PFC-free water.

For larger equipment (e.g., drill rigs), decontamination will be conducted with potable water using a high-pressure washer and then rinsed using potable water. Details regarding the decontamination of drilling equipment and other heavy equipment are presented below under the heading “Decontamination Procedures for Drilling Equipment and Other Heavy Equipment at PFC Sites”.

Personnel Hygiene

- ☐ Field personnel will not use cosmetics, moisturizers, hand cream, or other related products as part of their personal cleaning/showering routine on the morning of a sampling event, as these products may contain surfactants and represent a potential source of PFCs.
- ☐ Many manufactured sunblock and insect repellants contain PFCs and should not be brought or used on-site. Sunblock and insect repellants that are used on-site should consist of 100% natural ingredients. A list of acceptable sunscreens and insect repellents are listed in Table 1.
- ☐ For washroom breaks, field personnel will leave the exclusion zone and then remove gloves and overalls. Field personnel should wash as normal with extra time for rinsing with water after soap use. When finished washing, the use of a mechanical dryer is preferred and the use of paper towel for drying is to be avoided (if possible).

Food Considerations

- ☐ No food or drink shall be brought on-site, with the exception of bottled water and hydration drinks (i.e., Gatorade® and Powerade®), which will only be allowed to be brought and consumed within the staging area.

Visitors

- ☐ Visitors to the site are asked to remain outside of the exclusion zone during sampling activities.

Table 1. Summary of Prohibited and Acceptable Items for PFC Sampling

Prohibited	Acceptable
Field	
Teflon® containing materials	High-density polyethylene (HDPE) materials
Low density polyethylene (LDPE) materials	Acetate liners
	Silicon tubing
Waterproof field books	Loose paper (non-waterproof)
Plastic clipboards, binders, or spiral hard cover notebooks	Aluminum field clipboards or with Masonite
	Sharpies®, pens
Post-It Notes	
Chemical (blue) ice packs	Regular ice
Field Clothing and	
New cotton clothing or synthetic water resistant, waterproof, or stain-treated clothing, clothing containing Gore-Tex™	Well-laundered clothing made of natural fibers (preferable cotton)
Clothing laundered using fabric softener	No fabric
Boots containing Gore-Tex™	Boots made with polyurethane and PVC
Tyvek®	Cotton Clothing
No cosmetics, moisturizers, hand cream, or other related products as part of personal cleaning/showering routine on the morning of sampling	Sunscreens - Alba Organics Natural Sunscreen, Yes To Cucumbers, Aubrey Organics, Jason Natural Sun Block, Kiss my face, Baby sunscreens that are “free” or “natural” Insect Repellents - Jason Natural Quit Bugging Me, Repel Lemon Eucalyptus Insect repellent, Herbal Armor, California Baby Natural Bug Spray, BabyGanics Sunscreen and insect repellent - Avon Skin So Soft Bug Guard Plus – SPF 30 Lotion
Sample	
LDPE or glass containers	HDPE or polypropylene
Teflon®-lined caps	Unlined polypropylene caps
Rain	
Waterproof or resistant rain gear	Gazebo tent that is only touched or moved prior to and following sampling activities
Equipment	
Decon 90	Alconox® and/or Liquinox®
Water from an on-site well	Potable water from remote drinking water supply
Food	
All food and drink, with exceptions noted on the right	Bottled water and hydration drinks (i.e. Gatorade® and Powerade®) to be brought and consumed only in the staging area

Attachment 1
Daily PFC Protocol Checklist

Date: _____ Installation Name: _____

Weather (*temp./precipitation*): _____ Site Name: _____

Field Clothing and PPE:

- ☐ No clothing or boots containing Gore-TexTM
- ☐ All safety boots made from polyurethane and PVC
- ☐ No materials containing Tyvek®
- ☐ Field crew has not used fabric softener on clothing
- ☐ Field crew has not used cosmetics, moisturizers, hand cream, or other related products this morning
- ☐ Field crew has not applied unauthorized sunscreen or insect repellent

Field Equipment:

- ☐ No Teflon® or LDPE containing materials on-site
- ☐ All sample materials made from stainless steel, HDPE, acetate, silicon, or polypropylene
- ☐ No waterproof field books on-site
- ☐ No plastic clipboards, binders, or spiral hard cover notebooks on-site
- ☐ No adhesives (Post-It Notes) on-site

- ☐ Coolers filled with regular ice only. No chemical (blue) ice packs in possession

Sample Containers:

- ☐ All sample containers made of HDPE or polypropylene
- ☐ Caps are unlined and made of HDPE or polypropylene

Wet Weather (as applicable):

- ☐ Wet weather gear made of polyurethane and PVC only

Equipment Decontamination:

- ☐ “PFC-free” water on-site for decontamination of sample equipment. No other water sources to be used.
- ☐ Alconox and Liquinox to be used as decontamination materials

Food Considerations:

- ☐ No food or drink on-site with exception of bottled water and/or hydration drinks (i.e., Gatorade and Powerade) that is available for consumption only in the staging area

If any applicable boxes cannot be checked, the Field Manager shall describe the noncompliance issues below and work with field personnel to address noncompliance issues prior to commencement of that day’s work. Corrective action shall include removal of noncompliance items from the site or removal of worker offsite until in compliance. Repeated failure to comply with PFC sample protocols will result in the permanent removal of worker(s) from the site.

Describe the noncompliance issues (include personnel not in compliance) and action/outcome of noncompliance:

Field Manager Name: _____

Field Manager Signature: _____

Time: _____

DECONTAMINATION PROCEDURES FOR DRILLING EQUIPMENT AND OTHER HEAVY EQUIPMENT AT PFC SITES

These procedures establish guidelines for use by field personnel in the decontamination of drilling equipment and other heavy equipment when conducting PFC environmental assessments. The details are applicable as general requirements for drilling and heavy equipment decontamination, and should also be used in conjunction with the project QAPP.

Compliance with this procedure is the responsibility of project management and field personnel. These procedures and the project QAPP should be reviewed before implementing drilling, development, and heavy equipment decontamination at the project site.

This section provides requirements for the construction of a temporary decontamination facility for drilling, development, and heavy equipment and the decontamination procedures to be followed. The project QAPP provides specific information regarding:

- ☐ Types of equipment requiring decontamination under these procedures;
- ☐ Location of the decontamination station;
- ☐ Types and/or specifications on materials to be used in the fabrication of the decontamination station; and,
- ☐ Types of materials and additional details on the procedures to be used in the decontamination process.

Field personnel associated with construction of the decontamination station or decontamination of drilling or heavy equipment must read these procedures and the project QAPP prior to implementation of related decontamination activities.

Decontamination Facility

A decontamination facility will be set up in an area exclusively for decontamination of drilling equipment and other heavy equipment. Decontamination of drilling equipment and other heavy equipment will be conducted within the station.

At a minimum, the station will be constructed such that all rinsates, liquid spray, soil, debris, and other decontamination wastes are fully contained and may be collected for appropriate waste management and disposal. The facility may be as simple as a bermed pad lined with approved PFC-free, high density polyethylene (HDPE) sheeting with an impermeable sump for collecting rinse water. More sophisticated designs involving self-contained metal decontamination pads in combination with bermed HDPE sheeting may also be used, depending on project-specific requirements. These requirements along with specific equipment and construction specifications for the decontamination facility will be provided in the project QAPP.

Decontamination of Downhole Equipment

Downhole drilling and development equipment (including but not limited to drill pipe, drive casing, drill rods, bits, tools, nondisposable bailers, etc.) will be thoroughly decontaminated before mobilization to each site and between borings or wells at each site or as required in the project QAPP. The standard procedure will be performed as described below. Decontamination will be performed in accordance with these procedures and the project QAPP.

- ☐ Appropriate personal protective equipment (as specified in the project QAPP) must be worn by all personnel involved with the task to limit personal exposure.
- ☐ Equipment caked with drill cuttings, soil, or other material will initially be scraped or brushed. The scrapings will be staged and appropriately handled.
- ☐ Equipment will then be sprayed with potable water using a high-pressure washer.
- ☐ Washed equipment that will be used to collect the samples or will come into contact with the sampled media (such as the direct-push cutting shoe) will then be final rinsed with certified PFC-free water.
- ☐ Decontaminated downhole equipment (such as drill pipe, drive casing, bits, tools, bailers, etc.) will be placed on clean PFC-free, HDPE plastic sheeting to prevent contact with contaminated soil and allowed to air dry. If equipment is not used immediately, it will be covered or wrapped in PFC-free plastic sheeting to minimize airborne contamination.
- ☐ Decontamination activities will be documented by field personnel in the field log and/or appropriate form(s), as specified in the project QAPP.

Decontamination of Heavy Equipment

Heavy equipment (e.g., drill rigs, development rigs, backhoes, trucks, and other earthmoving equipment) will be decontaminated between drilling sites or inside the contaminant reduction area prior to entering and leaving an exclusion zone. Decontamination will be performed in accordance with the project work plans. The standard procedure will be performed as described below.

- ☐ Appropriate personal protective equipment will be worn by all personnel involved in the task, in order to limit personal exposure.
- ☐ Heavy equipment caked with drill cuttings, soil, or other material will be initially scraped or brushed to remove bulk soil.
- ☐ Heavy equipment will then be moved to the decontamination pad and sprayed with potable water using a high pressure washer.
- ☐ Those portions of the heavy equipment that will potentially contact the sample will be rinsed in a final rinse with lab provided “PFC-free” water.
- ☐ During the decontamination effort, fluid systems should be inspected for any leaks or problems, which might potentially result in an inadvertent release at the site, thereby

contributing to the volume of waste or contamination. Decontamination of heavy equipment should be performed before moving equipment between sites or before leaving the site.

- ☐ Decontamination activities will be documented in the field log and appropriate form(s), as specified in the project QAPP.



Department of
Environmental
Conservation

SAMPLING, ANALYSIS, AND ASSESSMENT OF PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS)

Under NYSDEC's Part 375 Remedial Programs

October 2020



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ERRATA SHEET for

**SAMPLING, ANALYSIS, AND ASSESSMENT OF PER- AND POLYFLUOROALKYL SUBSTANCES
 (PFAS) Under NYSDEC's Part 375 Remedial Programs Issued January 17, 2020**

Citation and Page Number	Current Text	Corrected Text	Date
Title of Appendix I, page 32	Appendix H	Appendix I	2/25/2020
Document Cover, page 1	Guidelines for Sampling and Analysis of PFAS	Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS) Under NYSDEC's Part 375 Remedial Programs	9/15/2020
Routine Analysis, page 9	"However, laboratories analyzing environmental samples...PFOA and PFOS in drinking water by EPA Method 537, 537.1 or ISO 25101."	"However, laboratories analyzing environmental samples...PFOA and PFOS in drinking water by EPA Method 537, 537.1, ISO 25101, or Method 533."	9/15/2020
Additional Analysis, page 9, new paragraph regarding soil parameters	None	"In cases where site-specific cleanup objectives for PFOA and PFOS are to be assessed, soil parameters, such as Total Organic Carbon (EPA Method 9060), soil pH (EPA Method 9045), clay content (percent), and cation exchange capacity (EPA Method 9081), should be included in the analysis to help evaluate factors affecting the leachability of PFAS in site soils."	9/15/2020
Data Assessment and Application to Site Cleanup Page 10	Until such time as Ambient Water Quality Standards (AWQS) and Soil Cleanup Objectives (SCOs) for PFAS are published, the extent of contaminated media potentially subject to remediation should be determined on a case-by-case basis using the procedures discussed below and the criteria in DER-10. Target levels for cleanup of PFAS in other media, including biota and sediment, have not yet been established by the DEC.	Until such time as Ambient Water Quality Standards (AWQS) and Soil Cleanup Objectives (SCOs) for PFOA and PFOS are published, the extent of contaminated media potentially subject to remediation should be determined on a case-by-case basis using the procedures discussed below and the criteria in DER-10. Preliminary target levels for cleanup of PFOA and PFOS in other media, including biota and sediment, have not yet been established by the DEC.	9/15/2020
Water Sample Results Page 10	PFAS should be further assessed and considered as a potential contaminant of concern in groundwater or surface water (...) If PFAS are identified as a contaminant of concern for a site, they should be assessed as	PFOA and PFOS should be further assessed and considered as potential contaminants of concern in groundwater or surface water (...) If PFOA and/or PFOS are identified as contaminants of concern for a site, they should be assessed as part of the remedy selection process in accordance with Part 375 and DER-10.	9/15/2020

Citation and Page Number	Current Text	Corrected Text	Date
	part of the remedy selection process in accordance with Part 375 and DER-10.		
Soil Sample Results, page 10	<p>“The extent of soil contamination for purposes of delineation and remedy selection should be determined by having certain soil samples tested by Synthetic Precipitation Leaching Procedure (SPLP) and the leachate analyzed for PFAS. Soil exhibiting SPLP results above 70 ppt for either PFOA or PFOS (individually or combined) are to be evaluated during the cleanup phase.”</p>	<p>“Soil cleanup objectives for PFOA and PFOS will be proposed in an upcoming revision to 6 NYCRR Part 375-6. Until SCOs are in effect, the following are to be used as guidance values. “</p> <p>[Guidance Value Table]</p> <p>“PFOA and PFOS results for soil are to be compared against the guidance values listed above. These guidance values are to be used in determining whether PFOA and PFOS are contaminants of concern for the site and for determining remedial action objectives and cleanup requirements. Site-specific remedial objectives for protection of groundwater can also be presented for evaluation by DEC. Development of site-specific remedial objectives for protection of groundwater will require analysis of additional soil parameters relating to leachability. These additional analyses can include any or all the parameters listed above (soil pH, cation exchange capacity, etc.) and/or use of SPLP.</p> <p>As the understanding of PFAS transport improves, DEC welcomes proposals for site-specific remedial objectives for protection of groundwater. DEC will expect that those may be dependent on additional factors including soil pH, aqueous pH, % organic carbon, % Sand/Silt/Clay, soil cations: K, Ca, Mg, Na, Fe, Al, cation exchange capacity, and anion exchange capacity. Site-specific remedial objectives should also consider the dilution attenuation factor (DAF). The NJDEP publication on DAF can be used as a reference: https://www.nj.gov/dep/srp/guidance/rs/daf.pdf. ”</p>	9/15/2020
Testing for Imported Soil Page 11	<p>Soil imported to a site for use in a soil cap, soil cover, or as backfill is to be tested for PFAS in general conformance with DER-10, Section 5.4(e) for the PFAS Analyte List (Appendix F) using the analytical procedures discussed below and the criteria in DER-10 associated with SVOCs.</p>	<p>Testing for PFAS should be included any time a full TAL/TCL analyte list is required. Results for PFOA and PFOS should be compared to the applicable guidance values. If PFOA or PFOS is detected in any sample at or above the guidance values then the source of backfill should be rejected, unless a site-specific exemption is provided by DER based on SPLP testing, for example. If the concentrations of PFOA and PFOS in leachate are at or above 10 ppt (the Maximum Contaminant Levels established for drinking water by the New York State Department of Health), then the soil is not acceptable.</p>	9/15/2020

Citation and Page Number	Current Text	Corrected Text	Date
	<p>If PFOA or PFOS is detected in any sample at or above 1 µg/kg, then soil should be tested by SPLP and the leachate analyzed for PFAS. If the SPLP results exceed 10 ppt for either PFOA or PFOS (individually) then the source of backfill should be rejected, unless a site-specific exemption is provided by DER. SPLP leachate criteria is based on the Maximum Contaminant Levels proposed for drinking water by New York State's Department of Health, this value may be updated based on future Federal or State promulgated regulatory standards. Remedial parties have the option of analyzing samples concurrently for both PFAS in soil and in the SPLP leachate to minimize project delays. Category B deliverables should be submitted for backfill samples, though a DUSR is not required.</p>	<p>PFOA, PFOS and 1,4-dioxane are all considered semi-volatile compounds, so composite samples are appropriate for these compounds when sampling in accordance with DER-10, Table 5.4(e)10. Category B deliverables should be submitted for backfill samples, though a DUSR is not required.</p>	
Footnotes	None	<p>¹ TOP Assay analysis of highly contaminated samples, such as those from an AFFF (aqueous film-forming foam) site, can result in incomplete oxidation of the samples and an underestimation of the total perfluoroalkyl substances.</p> <p>² The movement of PFAS in the environment is being aggressively researched at this time; that research will eventually result in more accurate models for the behaviors of these chemicals. In the meantime, DEC has calculated the soil cleanup objective for the protection of groundwater using the same procedure used for all other chemicals, as described in Section 7.7 of the Technical Support Document (http://www.dec.ny.gov/docs/remediation_hudson_pdf/techsuppdoc.pdf).</p>	9/15/2020

Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS) Under NYSDEC's Part 375 Remedial Programs

Objective

New York State Department of Environmental Conservation's Division of Environmental Remediation (DER) performs or oversees sampling of environmental media and subsequent analysis of PFAS as part of remedial programs implemented under 6 NYCRR Part 375. To ensure consistency in sampling, analysis, reporting, and assessment of PFAS, DER has developed this document which summarizes currently accepted procedures and updates previous DER technical guidance pertaining to PFAS.

Applicability

All work plans submitted to DEC pursuant to one of the remedial programs under Part 375 shall include PFAS sampling and analysis procedures that conform to the guidelines provided herein.

As part of a site investigation or remedial action compliance program, whenever samples of potentially affected media are collected and analyzed for the standard Target Analyte List/Target Compound List (TAL/TCL), PFAS analysis should also be performed. Potentially affected media can include soil, groundwater, surface water, and sediment. Based upon the potential for biota to be affected, biota sampling and analysis for PFAS may also be warranted as determined pursuant to a Fish and Wildlife Impact Analysis. Soil vapor sampling for PFAS is not required.

Field Sampling Procedures

DER-10 specifies technical guidance applicable to DER's remedial programs. Given the prevalence and use of PFAS, DER has developed "best management practices" specific to sampling for PFAS. As specified in DER-10 Chapter 2, quality assurance procedures are to be submitted with investigation work plans. Typically, these procedures are incorporated into a work plan, or submitted as a stand-alone document (e.g., a Quality Assurance Project Plan). Quality assurance guidelines for PFAS are listed in Appendix A - Quality Assurance Project Plan (QAPP) Guidelines for PFAS.

Field sampling for PFAS performed under DER remedial programs should follow the appropriate procedures outlined for soils, sediments or other solids (Appendix B), non-potable groundwater (Appendix C), surface water (Appendix D), public or private water supply wells (Appendix E), and fish tissue (Appendix F).

QA/QC samples (e.g. duplicates, MS/MSD) should be collected as specified in DER-10, Section 2.3(c). For sampling equipment coming in contact with aqueous samples only, rinsate or equipment blanks should be collected.

Equipment blanks should be collected at a minimum frequency of one per day per site or one per twenty samples, whichever is more frequent.

Analysis and Reporting

As of October 2020, the United States Environmental Protection Agency (EPA) does not have a validated method for analysis of PFAS for media commonly analyzed under DER remedial programs (non-potable waters, solids). DER has developed the following guidelines to ensure consistency in analysis and reporting of PFAS.

The investigation work plan should describe analysis and reporting procedures, including laboratory analytical procedures for the methods discussed below. As specified in DER-10 Section 2.2, laboratories should provide a full Category B deliverable. In addition, a Data Usability Summary Report (DUSR) should be prepared by an independent, third party data validator. Electronic data submissions should meet the requirements provided at: <https://www.dec.ny.gov/chemical/62440.html>.

DER has developed a *PFAS Analyte List* (Appendix F) for remedial programs to understand the nature of contamination at sites. It is expected that reported results for PFAS will include, at a minimum, all the compounds listed. If lab and/or matrix specific issues are encountered for any analytes, the DER project manager, in consultation with the DER chemist, will make case-by-case decisions as to whether certain analytes may be temporarily or permanently discontinued from analysis at each site. As with other contaminants that are analyzed for at a site, the *PFAS Analyte List* may be refined for future sampling events based on investigative findings.

Routine Analysis

Currently, New York State Department of Health's Environmental Laboratory Approval Program (ELAP) does not offer certification for PFAS in matrices other than finished drinking water. However, laboratories analyzing environmental samples for PFAS (e.g., soil, sediments, and groundwater) under DER's Part 375 remedial programs need to hold ELAP certification for PFOA and PFOS in drinking water by EPA Method 537, 537.1, ISO 25101, or Method 533. Laboratories should adhere to the guidelines and criteria set forth in the DER's laboratory guidelines for PFAS in non-potable water and solids (Appendix H - Laboratory Guidelines for Analysis of PFAS in Non-Potable Water and Solids). Data review guidelines were developed by DER to ensure data comparability and usability (Appendix H - Data Review Guidelines for Analysis of PFAS in Non-Potable Water and Solids).

LC-MS/MS analysis for PFAS using methodologies based on EPA Method 537.1 is the procedure to use for environmental samples. Isotope dilution techniques should be utilized for the analysis of PFAS in all media. Reporting limits for PFOA and PFOS in aqueous samples should not exceed 2 ng/L. Reporting limits for PFOA and PFOS in solid samples should not exceed 0.5 µg/kg. Reporting limits for all other PFAS in aqueous and solid media should be as close to these limits as possible. If laboratories indicate that they are not able to achieve these reporting limits for the entire *PFAS Analyte List*, site-specific decisions regarding acceptance of elevated reporting limits for specific PFAS can be made by the DER project manager in consultation with the DER chemist.

Additional Analysis

Additional laboratory methods for analysis of PFAS may be warranted at a site, such as the Synthetic Precipitation Leaching Procedure (SPLP) and Total Oxidizable Precursor Assay (TOP Assay).

In cases where site-specific cleanup objectives for PFOA and PFOS are to be assessed, soil parameters, such as Total Organic Carbon (EPA Method 9060), soil pH (EPA Method 9045), clay content (percent), and cation exchange capacity (EPA Method 9081), should be included in the analysis to help evaluate factors affecting the leachability of PFAS in site soils.

SPLP is a technique used to determine the mobility of chemicals in liquids, soils and wastes, and may be useful in determining the need for addressing PFAS-containing material as part of the remedy. SPLP by EPA Method 1312 should be used unless otherwise specified by the DER project manager in consultation with the DER chemist.

Impacted materials can be made up of PFAS that are not analyzable by routine analytical methodology. A TOP Assay can be utilized to conceptualize the amount and type of oxidizable PFAS which could be liberated in the environment, which approximates the maximum concentration of perfluoroalkyl substances that could be generated if all polyfluoroalkyl substances were oxidized. For example, some polyfluoroalkyl substances may degrade or transform to form perfluoroalkyl substances (such as PFOA or PFOS), resulting in an increase in perfluoroalkyl substance concentrations as contaminated groundwater moves away from a source. The TOP Assay converts, through oxidation, polyfluoroalkyl substances (precursors) into perfluoroalkyl substances that can be detected by routine analytical methodology.¹

Commercial laboratories have adopted methods which allow for the quantification of targeted PFAS in air and biota. The EPA's Office of Research and Development (ORD) is currently developing methods which allow for air emissions characterization of PFAS, including both targeted and non-targeted analysis of PFAS. Consult with the DER project manager and the DER chemist for assistance on analyzing biota/tissue and air samples.

Data Assessment and Application to Site Cleanup

Until such time as Ambient Water Quality Standards (AWQS) and Soil Cleanup Objectives (SCOs) for PFOA and PFOS are published, the extent of contaminated media potentially subject to remediation should be determined on a case-by-case basis using the procedures discussed below and the criteria in DER-10. Preliminary target levels for cleanup of PFOA and PFOS in other media, including biota and sediment, have not yet been established by the DEC.

Water Sample Results

PFOA and PFOS should be further assessed and considered as potential contaminants of concern in groundwater or surface water if PFOA or PFOS is detected in any water sample at or above 10 ng/L (ppt) and is determined to be attributable to the site, either by a comparison of upgradient and downgradient levels, or the presence of soil source areas, as defined below. In addition, further assessment of water may be warranted if either of the following screening levels are met:

- a. any other individual PFAS (not PFOA or PFOS) is detected in water at or above 100 ng/L; or
- b. total concentration of PFAS (including PFOA and PFOS) is detected in water at or above 500 ng/L

If PFOA and/or PFOS are identified as contaminants of concern for a site, they should be assessed as part of the remedy selection process in accordance with Part 375 and DER-10.

Soil Sample Results

Soil cleanup objectives for PFOA and PFOS will be proposed in an upcoming revision to 6 NYCRR Part 375-6. Until SCOs are in effect, the following are to be used as guidance values.

¹ TOP Assay analysis of highly contaminated samples, such as those from an AFFF (aqueous film-forming foam) site, can result in incomplete oxidation of the samples and an underestimation of the total perfluoroalkyl substances.

Guidance Values for Anticipated Site Use	PFOA (ppb)	PFOS (ppb)
Unrestricted	0.66	0.88
Residential	6.6	8.8
Restricted Residential	33	44
Commercial	500	440
Industrial	600	440
Protection of Groundwater ²	1.1	3.7

PFOA and PFOS results for soil are to be compared against the guidance values listed above. These guidance values are to be used in determining whether PFOA and PFOS are contaminants of concern for the site and for determining remedial action objectives and cleanup requirements. Site-specific remedial objectives for protection of groundwater can also be presented for evaluation by DEC. Development of site-specific remedial objectives for protection of groundwater will require analysis of additional soil parameters relating to leachability. These additional analyses can include any or all the parameters listed above (soil pH, cation exchange capacity, etc.) and/or use of SPLP.

As the understanding of PFAS transport improves, DEC welcomes proposals for site-specific remedial objectives for protection of groundwater. DEC will expect that those may be dependent on additional factors including soil pH, aqueous pH, % organic carbon, % Sand/Silt/Clay, soil cations: K, Ca, Mg, Na, Fe, Al, cation exchange capacity, and anion exchange capacity. Site-specific remedial objectives should also consider the dilution attenuation factor (DAF). The NJDEP publication on DAF can be used as a reference:

<https://www.nj.gov/dep/srp/guidance/rs/daf.pdf>.

Testing for Imported Soil

Testing for PFAS should be included any time a full TAL/TCL analyte list is required. Results for PFOA and PFOS should be compared to the applicable guidance values. If PFOA or PFOS is detected in any sample at or above the guidance values then the source of backfill should be rejected, unless a site-specific exemption is provided by DER based on SPLP testing, for example. If the concentrations of PFOA and PFOS in leachate are at or above 10 ppt (the Maximum Contaminant Levels established for drinking water by the New York State Department of Health), then the soil is not acceptable.

PFOA, PFOS and 1,4-dioxane are all considered semi-volatile compounds, so composite samples are appropriate for these compounds when sampling in accordance with DER-10, Table 5.4(e)10. Category B deliverables should be submitted for backfill samples, though a DUSR is not required.

² The movement of PFAS in the environment is being aggressively researched at this time; that research will eventually result in more accurate models for the behaviors of these chemicals. In the meantime, DEC has calculated the guidance value for the protection of groundwater using the same procedure used for all other chemicals, as described in Section 7.7 of the Technical Support Document (http://www.dec.ny.gov/docs/remediation_hudson_pdf/techsuppdoc.pdf).

Appendix A - Quality Assurance Project Plan (QAPP) Guidelines for PFAS

The following guidelines (general and PFAS-specific) can be used to assist with the development of a QAPP for projects within DER involving sampling and analysis of PFAS.

General Guidelines in Accordance with DER-10

- Document/work plan section title – Quality Assurance Project Plan
- Summarize project scope, goals, and objectives
- Provide project organization including names and resumes of the project manager, Quality Assurance Officer (QAO), field staff, and Data Validator
 - The QAO should not have another position on the project, such as project or task manager, that involves project productivity or profitability as a job performance criterion
- List the ELAP-approved lab(s) to be used for analysis of samples
- Include a site map showing sample locations
- Provide detailed sampling procedures for each matrix
- Include Data Quality Usability Objectives
- List equipment decontamination procedures
- Include an “Analytical Methods/Quality Assurance Summary Table” specifying:
 - Matrix type
 - Number or frequency of samples to be collected per matrix
 - Number of field and trip blanks per matrix
 - Analytical parameters to be measured per matrix
 - Analytical methods to be used per matrix with minimum reporting limits
 - Number and type of matrix spike and matrix spike duplicate samples to be collected
 - Number and type of duplicate samples to be collected
 - Sample preservation to be used per analytical method and sample matrix
 - Sample container volume and type to be used per analytical method and sample matrix
 - Sample holding time to be used per analytical method and sample matrix
- Specify Category B laboratory data deliverables and preparation of a DUSR

Specific Guidelines for PFAS

- Include in the text that sampling for PFAS will take place
- Include in the text that PFAS will be analyzed by LC-MS/MS for PFAS using methodologies based on EPA Method 537.1
- Include the list of PFAS compounds to be analyzed (*PFAS Analyte List*)
- Include the laboratory SOP for PFAS analysis
- List the minimum method-achievable Reporting Limits for PFAS
 - Reporting Limits should be less than or equal to:
 - Aqueous – 2 ng/L (ppt)
 - Solids – 0.5 µg/kg (ppb)
- Include the laboratory Method Detection Limits for the PFAS compounds to be analyzed
- Laboratory should have ELAP certification for PFOA and PFOS in drinking water by EPA Method 537, 537.1, EPA Method 533, or ISO 25101
- Include detailed sampling procedures
 - Precautions to be taken
 - Pump and equipment types
 - Decontamination procedures
 - Approved materials only to be used
- Specify that regular ice only will be used for sample shipment

October 2020

- Specify that equipment blanks should be collected at a minimum frequency of 1 per day per site for each matrix

Appendix B - Sampling Protocols for PFAS in Soils, Sediments and Solids

General

The objective of this protocol is to give general guidelines for the collection of soil, sediment and other solid samples for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Containers

Samples collected using this protocol are intended to be analyzed for PFAS using methodologies based on EPA Method 537.1.

The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation's Division of Environmental Remediation.

No sampling equipment components or sample containers should come in to contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials including sample bottle cap liners with a PTFE layer.

A list of acceptable equipment is provided below, but other equipment may be considered appropriate based on sampling conditions.

- stainless steel spoon
- stainless steel bowl
- steel hand auger or shovel without any coatings

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification.

Sampling Techniques

Sampling is often conducted in areas where a vegetative turf has been established. In these cases, a pre-cleaned trowel or shovel should be used to carefully remove the turf so that it may be replaced at the conclusion of sampling. Surface soil samples (e.g. 0 to 6 inches below surface) should then be collected using a pre-cleaned, stainless steel spoon. Shallow subsurface soil samples (e.g. 6 to ~36 inches below surface) may be collected by digging a hole using a pre-cleaned hand auger or shovel. When the desired subsurface depth is reached, a pre-cleaned hand auger or spoon shall be used to obtain the sample.

When the sample is obtained, it should be deposited into a stainless steel bowl for mixing prior to filling the sample containers. The soil should be placed directly into the bowl and mixed thoroughly by rolling the material into the

middle until the material is homogenized. At this point the material within the bowl can be placed into the laboratory provided container.

Sample Identification and Logging

A label shall be attached to each sample container with a unique identification. Each sample shall be included on the chain of custody (COC).

Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at $4 \pm 2^\circ$ Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- Request appropriate data deliverable (Category B) and an electronic data deliverable

Documentation

A soil log or sample log shall document the location of the sample/borehole, depth of the sample, sampling equipment, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate. Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appropriate rain gear (PVC, polyurethane, or rubber rain gear are acceptable), bug spray, and sunscreen should be used that does not contain PFAS. Well washed cotton coveralls may be used as an alternative to bug spray and/or sunscreen.

PPE that contains PFAS is acceptable when site conditions warrant additional protection for the samplers and no other materials can be used to be protective. Documentation of such use should be provided in the field notes.

Appendix C - Sampling Protocols for PFAS in Monitoring Wells

General

The objective of this protocol is to give general guidelines for the collection of groundwater samples for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Container

Samples collected using this protocol are intended to be analyzed for PFAS using methodologies based on EPA Method 537.1.

The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include: stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation's Division of Environmental Remediation.

No sampling equipment components or sample containers should come in contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials including plumbers tape and sample bottle cap liners with a PTFE layer.

A list of acceptable equipment is provided below, but other equipment may be considered appropriate based on sampling conditions.

- stainless steel inertia pump with HDPE tubing
- peristaltic pump equipped with HDPE tubing and silicone tubing
- stainless steel bailer with stainless steel ball
- bladder pump (identified as PFAS-free) with HDPE tubing

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification.

Sampling Techniques

Monitoring wells should be purged in accordance with the sampling procedure (standard/volume purge or low flow purge) identified in the site work plan, which will determine the appropriate time to collect the sample. If sampling using standard purge techniques, additional purging may be needed to reduce turbidity levels, so samples contain a limited amount of sediment within the sample containers. Sample containers that contain sediment may cause issues at the laboratory, which may result in elevated reporting limits and other issues during the sample preparation that can compromise data usability. Sampling personnel should don new nitrile gloves prior to sample collection due to the potential to contact PFAS containing items (not related to the sampling equipment) during the purging activities.

Sample Identification and Logging

A label shall be attached to each sample container with a unique identification. Each sample shall be included on the chain of custody (COC).

Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at $4 \pm 2^\circ$ Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- Collect one equipment blank per day per site and minimum 1 equipment blank per 20 samples. The equipment blank shall test the new and decontaminated sampling equipment utilized to obtain a sample for residual PFAS contamination. This sample is obtained by using laboratory provided PFAS-free water and passing the water over or through the sampling device and into laboratory provided sample containers
- Additional equipment blank samples may be collected to assess other equipment that is utilized at the monitoring well
- Request appropriate data deliverable (Category B) and an electronic data deliverable

Documentation

A purge log shall document the location of the sample, sampling equipment, groundwater parameters, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate. Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appropriate rain gear (PVC, polyurethane, or rubber rain gear are acceptable), bug spray, and sunscreen should be used that does not contain PFAS. Well washed cotton coveralls may be used as an alternative to bug spray and/or sunscreen.

PPE that contains PFAS is acceptable when site conditions warrant additional protection for the samplers and no other materials can be used to be protective. Documentation of such use should be provided in the field notes.

Appendix D - Sampling Protocols for PFAS in Surface Water

General

The objective of this protocol is to give general guidelines for the collection of surface water samples for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Container

Samples collected using this protocol are intended to be analyzed for PFAS using methodologies based on EPA Method 537.1.

The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include: stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation's Division of Environmental Remediation.

No sampling equipment components or sample containers should come in contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials including sample bottle cap liners with a PTFE layer.

A list of acceptable equipment is provided below, but other equipment may be considered appropriate based on sampling conditions.

- stainless steel cup

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification.

Sampling Techniques

Where conditions permit, (e.g. creek or pond) sampling devices (e.g. stainless steel cup) should be rinsed with site medium to be sampled prior to collection of the sample. At this point the sample can be collected and poured into the sample container.

If site conditions permit, samples can be collected directly into the laboratory container.

Sample Identification and Logging

A label shall be attached to each sample container with a unique identification. Each sample shall be included on the chain of custody (COC).

Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at $4 \pm 2^\circ$ Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- Collect one equipment blank per day per site and minimum 1 equipment blank per 20 samples. The equipment blank shall test the new and decontaminated sampling equipment utilized to obtain a sample for residual PFAS contamination. This sample is obtained by using laboratory provided PFAS-free water and passing the water over or through the sampling device and into laboratory provided sample containers
- Request appropriate data deliverable (Category B) and an electronic data deliverable

Documentation

A sample log shall document the location of the sample, sampling equipment, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate. Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appropriate rain gear (PVC, polyurethane, or rubber rain gear are acceptable), bug spray, and sunscreen should be used that does not contain PFAS. Well washed cotton coveralls may be used as an alternative to bug spray and/or sunscreen.

PPE that contains PFAS is acceptable when site conditions warrant additional protection for the samplers and no other materials can be used to be protective. Documentation of such use should be provided in the field notes.

Appendix E - Sampling Protocols for PFAS in Private Water Supply Wells

General

The objective of this protocol is to give general guidelines for the collection of water samples from private water supply wells (with a functioning pump) for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Container

Drinking water samples collected using this protocol are intended to be analyzed for PFAS by ISO Method 25101. The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include: stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation's Division of Environmental Remediation.

No sampling equipment components or sample containers should come in contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials (e.g. plumbers tape), including sample bottle cap liners with a PTFE layer.

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification.

Sampling Techniques

Locate and assess the pressure tank and determine if any filter units are present within the building. Establish the sample location as close to the well pump as possible, which is typically the spigot at the pressure tank. Ensure sampling equipment is kept clean during sampling as access to the pressure tank spigot, which is likely located close to the ground, may be obstructed and may hinder sample collection.

Prior to sampling, a faucet downstream of the pressure tank (e.g., washroom sink) should be run until the well pump comes on and a decrease in water temperature is noted which indicates that the water is coming from the well. If the homeowner is amenable, staff should run the water longer to purge the well (15+ minutes) to provide a sample representative of the water in the formation rather than standing water in the well and piping system including the pressure tank. At this point a new pair of nitrile gloves should be donned and the sample can be collected from the sample point at the pressure tank.

Sample Identification and Logging

A label shall be attached to each sample container with a unique identification. Each sample shall be included on the chain of custody (COC).

Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at $4 \pm 2^\circ$ Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- If equipment was used, collect one equipment blank per day per site and a minimum 1 equipment blank per 20 samples. The equipment blank shall test the new and decontaminated sampling equipment utilized to obtain a sample for residual PFAS contamination. This sample is obtained by using laboratory provided PFAS-free water and passing the water over or through the sampling device and into laboratory provided sample containers.
- A field reagent blank (FRB) should be collected at a rate of one per 20 samples. The lab will provide a FRB bottle containing PFAS free water and one empty FRB bottle. In the field, pour the water from the one bottle into the empty FRB bottle and label appropriately.
- Request appropriate data deliverable (Category B) and an electronic data deliverable
- For sampling events where multiple private wells (homes or sites) are to be sampled per day, it is acceptable to collect QC samples at a rate of one per 20 across multiple sites or days.

Documentation

A sample log shall document the location of the private well, sample point location, owner contact information, sampling equipment, purge duration, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate and available (e.g. well construction, pump type and location, yield, installation date). Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appendix F - Sampling Protocols for PFAS in Fish

This appendix contains a copy of the latest guidelines developed by the Division of Fish and Wildlife (DFW) entitled “General Fish Handling Procedures for Contaminant Analysis” (Ver. 8).

Procedure Name: General Fish Handling Procedures for Contaminant Analysis

Number: FW-005

Purpose: This procedure describes data collection, fish processing and delivery of fish collected for contaminant monitoring. It contains the chain of custody and collection record forms that should be used for the collections.

Organization: Environmental Monitoring Section
Bureau of Ecosystem Health
Division of Fish and Wildlife (DFW)
New York State Department of Environmental Conservation (NYSDEC)
625 Broadway
Albany, New York 12233-4756

Version: 8

Previous Version Date: 21 March 2018

Summary of Changes to this Version: Updated bureau name to Bureau of Ecosystem Health. Added direction to list the names of all field crew on the collection record. Minor formatting changes on chain of custody and collection records.

Originator or Revised by: Wayne Richter, Jesse Becker

Date: 26 April 2019

Quality Assurance Officer and Approval Date: Jesse Becker, 26 April 2019

**NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION**

GENERAL FISH HANDLING PROCEDURES FOR CONTAMINANT ANALYSES

- A. Original copies of all continuity of evidence (i.e., Chain of Custody) and collection record forms must accompany delivery of fish to the lab. A copy shall be directed to the Project Leader or as appropriate, Wayne Richter. All necessary forms will be supplied by the Bureau of Ecosystem Health. Because some samples may be used in legal cases, it is critical that each section is filled out completely. Each Chain of Custody form has three main sections:
1. The top box is to be filled out **and signed** by the person responsible for the fish collection (e.g., crew leader, field biologist, researcher). This person is responsible for delivery of the samples to DEC facilities or personnel (e.g., regional office or biologist).
 2. The second section is to be filled out **and signed** by the person responsible for the collections while being stored at DEC, before delivery to the analytical lab. This may be the same person as in (1), but it is still required that they complete the section. Also important is the **range of identification numbers** (i.e., tag numbers) included in the sample batch.
 3. Finally, the bottom box is to record any transfers between DEC personnel and facilities. Each subsequent transfer should be **identified, signed, and dated**, until laboratory personnel take possession of the fish.
- B. The following data are required on each **Fish Collection Record** form:
1. Project and Site Name.
 2. DEC Region.
 3. All personnel (and affiliation) involved in the collection.
 4. Method of collection (gill net, hook and line, etc.)
 5. Preservation Method.
- C. The following data are to be taken on each fish collected and recorded on the **Fish Collection Record** form:
1. Tag number - Each specimen is to be individually jaw tagged at time of collection with a unique number. Make sure the tag is turned out so that the number can be read without opening the bag. Use tags in sequential order. For small fish or composite samples place the tag inside the bag with the samples. The Bureau of Ecosystem Health can supply the tags.
 2. Species identification (please be explicit enough to enable assigning genus and species). Group fish by species when processing.
 3. Date collected.
 4. Sample location (waterway and nearest prominent identifiable landmark).
 5. Total length (nearest mm or smallest sub-unit on measuring instrument) and weight (nearest g or

smallest sub-unit of weight on weighing instrument). Take all measures as soon as possible with calibrated, protected instruments (e.g. from wind and upsets) and prior to freezing.

6. Sex - fish may be cut enough to allow sexing or other internal investigation, but do not eviscerate. Make any incision on the right side of the belly flap or exactly down the midline so that a left-side fillet can be removed.

D. General data collection recommendations:

1. It is helpful to use an ID or tag number that will be unique. It is best to use metal striped bass or other uniquely numbered metal tags. If uniquely numbered tags are unavailable, values based on the region, water body and year are likely to be unique: for example, R7CAY11001 for Region 7, Cayuga Lake, 2011, fish 1. If the fish are just numbered 1 through 20, we have to give them new numbers for our database, making it more difficult to trace your fish to their analytical results and creating an additional possibility for errors.
 2. Process and record fish of the same species sequentially. Recording mistakes are less likely when all fish from a species are processed together. Starting with the bigger fish species helps avoid missing an individual.
 3. If using Bureau of Ecosystem Health supplied tags or other numbered tags, use tags in sequence so that fish are recorded with sequential Tag Numbers. This makes data entry and login at the lab and use of the data in the future easier and reduces keypunch errors.
 4. Record length and weight as soon as possible after collection and before freezing. Other data are recorded in the field upon collection. An age determination of each fish is optional, but if done, it is recorded in the appropriate "Age" column.
 5. For composite samples of small fish, record the number of fish in the composite in the Remarks column. Record the length and weight of each individual in a composite. All fish in a composite sample should be of the same species and members of a composite should be visually matched for size.
 6. Please submit photocopies of topographic maps or good quality navigation charts indicating sampling locations. GPS coordinates can be entered in the Location column of the collection record form in addition to or instead for providing a map. These records are of immense help to us (and hopefully you) in providing documented location records which are not dependent on memory and/or the same collection crew. In addition, they may be helpful for contaminant source trackdown and remediation/control efforts of the Department.
 7. When recording data on fish measurements, it will help to ensure correct data recording for the data recorder to call back the numbers to the person making the measurements.
- E. Each fish is to be placed in its own individual plastic bag. For small fish to be analyzed as a composite, put all of the fish for one composite in the same bag but use a separate bag for each composite. It is important to individually bag the fish to avoid difficulties or cross contamination when processing the fish for chemical analysis. Be sure to include the fish's tag number inside the bag, preferably attached to the fish with the tag number turned out so it can be read. Tie or otherwise secure the bag closed. **The Bureau of Ecosystem Health will supply the bags.** If necessary, food grade bags may be procured from a suitable vendor (e.g., grocery store). It is preferable to redundantly label each bag with a manila tag tied between the knot and the body of the bag. This tag should be labeled with the project name, collection location, tag number, collection date, and fish species. If scales are collected, the scale envelope should be labeled with

the same information.

- F. Groups of fish, by species, are to be placed in one large plastic bag per sampling location. **The Bureau of Ecosystem Health will supply the larger bags.** Tie or otherwise secure the bag closed. Label the site bag with a manila tag tied between the knot and the body of the bag. The tag should contain: project, collection location, collection date, species and **tag number ranges**. Having this information on the manila tag enables lab staff to know what is in the bag without opening it.
- G. Do not eviscerate, fillet or otherwise dissect the fish unless specifically asked to. If evisceration or dissection is specified, the fish must be cut along the exact midline or on the right side so that the left side fillet can be removed intact at the laboratory. If filleting is specified, the procedure for taking a standard fillet (SOP PREPLAB 4) must be followed, including removing scales.
- H. Special procedures for PFAS: Unlike legacy contaminants such as PCBs, which are rarely found in day to day life, PFAS are widely used and frequently encountered. Practices that avoid sample contamination are therefore necessary. While no standard practices have been established for fish, procedures for water quality sampling can provide guidance. The following practices should be used for collections when fish are to be analyzed for PFAS:
 - No materials containing Teflon.
 - No Post-it notes.
 - No ice packs; only water ice or dry ice.
 - Any gloves worn must be powder free nitrile.
 - No Gore-Tex or similar materials (Gore-Tex is a PFC with PFOA used in its manufacture).
 - No stain repellent or waterproof treated clothing; these are likely to contain PFCs.
 - Avoid plastic materials, other than HDPE, including clipboards and waterproof notebooks.
 - Wash hands after handling any food containers or packages as these may contain PFCs.
 - Keep pre-wrapped food containers and wrappers isolated from fish handling.
 - Wear clothing washed at least six times since purchase.
 - Wear clothing washed without fabric softener.
 - Staff should avoid cosmetics, moisturizers, hand creams and similar products on the day of sampling as many of these products contain PFCs (Fujii et al. 2013). Sunscreen or insect repellent should not contain ingredients with “fluor” in their name. Apply any sunscreen or insect repellent well downwind from all materials. Hands must be washed after touching any of these products.
- I. All fish must be kept at a temperature <45° F (<8° C) immediately following data processing. As soon as possible, freeze at -20° C ± 5° C. Due to occasional freezer failures, daily freezer temperature logs are required. The freezer should be locked or otherwise secured to maintain chain of custody.
- J. In most cases, samples should be delivered to the Analytical Services Unit at the Hale Creek field station. Coordinate delivery with field station staff and send copies of the collection records, continuity of evidence forms and freezer temperature logs to the field station. For samples to be analyzed elsewhere, non-routine collections or other questions, contact Wayne Richter, Bureau of Ecosystem Health, NYSDEC, 625 Broadway, Albany, New York 12233-4756, 518-402-8974, or the project leader about sample transfer. Samples will then be directed to the analytical facility and personnel noted on specific project descriptions.
- K. A recommended equipment list is at the end of this document.

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF FISH AND WILDLIFE
FISH COLLECTION RECORD

page _____ of _____

Project and Site Name _____ DEC Region _____

Collections made by (include all crew) _____

Sampling Method: ☐ Electrofishing ☐ Gill netting ☐ Trap netting ☐ Trawling ☐ Seining ☐ Angling ☐ Other _____

Preservation Method: ☐ Freezing ☐ Other _____ Notes (SWFDB survey number): _____

FOR LAB USE ONLY- LAB ENTRY NO.	COLLECTION OR TAG NO.	SPECIES	DATE TAKEN	LOCATION	AGE	SEX &/OR REPROD. CONDIT	LENGTH ()	WEIGHT ()	REMARKS

richter: revised 2011, 5/7/15, 10/4/16, 3/20/17; becker: 3/23/17, 4/26/19

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION CHAIN OF CUSTODY

I, _____, of _____ collected the
(Print Name) (Print Business Address)
 following on _____, 20____ from _____
(Date) (Water Body)
 in the vicinity of _____
(Landmark, Village, Road, etc.)
 Town of _____, in _____ County.
 Item(s) _____

Said sample(s) were in my possession and handled according to standard procedures provided to me prior to collection. The sample(s) were placed in the custody of a representative of the New York State Department of Environmental Conservation on _____, 20____.

Signature Date

I, _____, received the above mentioned sample(s) on the date specified and assigned identification number(s) _____ to the sample(s). I have recorded pertinent data for the sample(s) on the attached collection records. The sample(s) remained in my custody until subsequently transferred, prepared or shipped at times and on dates as attested to below.

Signature Date

SECOND RECIPIENT (Print Name)	TIME & DATE	PURPOSE OF TRANSFER
SIGNATURE	UNIT	
THIRD RECIPIENT (Print Name)	TIME & DATE	PURPOSE OF TRANSFER
SIGNATURE	UNIT	
FOURTH RECIPIENT (Print Name)	TIME & DATE	PURPOSE OF TRANSFER
SIGNATURE	UNIT	
RECEIVED IN LABORATORY BY (Print Name)	TIME & DATE	REMARKS
SIGNATURE	UNIT	
LOGGED IN BY (Print Name)	TIME & DATE	ACCESSION NUMBERS
SIGNATURE	UNIT	

NOTICE OF WARRANTY

By signature to the chain of custody (reverse), the signatory warrants that the information provided is truthful and accurate to the best of his/her ability. The signatory affirms that he/she is willing to testify to those facts provided and the circumstances surrounding the same. Nothing in this warranty or chain of custody negates responsibility nor liability of the signatories for the truthfulness and accuracy of the statements provided.

HANDLING INSTRUCTIONS

On day of collection, collector(s) name(s), address(es), date, geographic location of capture (attach a copy of topographic map or navigation chart), species, number kept of each species, and description of capture vicinity (proper noun, if possible) along with name of Town and County must be indicated on reverse.

Retain organisms in manila tagged plastic bags to avoid mixing capture locations. Note appropriate information on each bag tag.

Keep samples as cool as possible. Put on ice if fish cannot be frozen within 12 hours. If fish are held more than 24 hours without freezing, they will not be retained or analyzed.

Initial recipient (either DEC or designated agent) of samples from collector(s) is responsible for obtaining and recording information on the collection record forms which will accompany the chain of custody. This person will seal the container using packing tape and writing his signature, the time and the date across the tape onto the container with indelible marker. Any time a seal is broken, for whatever purpose, the incident must be recorded on the Chain of Custody (reason, time, and date) in the purpose of transfer block. Container then is resealed using new tape and rewriting signature, with time and date.

EQUIPMENT LIST

Scale or balance of appropriate capacity for the fish to be collected.

Fish measuring board.

Plastic bags of an appropriate size for the fish to be collected and for site bags.

Individually numbered metal tags for fish.

Manila tags to label bags.

Small envelopes, approximately 2" x 3.5", if fish scales are to be collected.

Knife for removing scales.

Chain of custody and fish collection forms.

Clipboard.

Pens or markers.

Paper towels.

Dish soap and brush.

Bucket.

Cooler.

Ice.

Duct tape.

Appendix G – PFAS Analyte List

Group	Chemical Name	Abbreviation	CAS Number
Perfluoroalkyl sulfonates	Perfluorobutanesulfonic acid	PFBS	375-73-5
	Perfluorohexanesulfonic acid	PFHxS	355-46-4
	Perfluoroheptanesulfonic acid	PFHpS	375-92-8
	Perfluorooctanesulfonic acid	PFOS	1763-23-1
	Perfluorodecanesulfonic acid	PFDS	335-77-3
Perfluoroalkyl carboxylates	Perfluorobutanoic acid	PFBA	375-22-4
	Perfluoropentanoic acid	PFPeA	2706-90-3
	Perfluorohexanoic acid	PFHxA	307-24-4
	Perfluoroheptanoic acid	PFHpA	375-85-9
	Perfluorooctanoic acid	PFOA	335-67-1
	Perfluorononanoic acid	PFNA	375-95-1
	Perfluorodecanoic acid	PFDA	335-76-2
	Perfluoroundecanoic acid	PFUA/PFUdA	2058-94-8
	Perfluorododecanoic acid	PFDaA	307-55-1
	Perfluorotridecanoic acid	PFTriA/PFTTrDA	72629-94-8
	Perfluorotetradecanoic acid	PFTA/PFTeDA	376-06-7
Fluorinated Telomer Sulfonates	6:2 Fluorotelomer sulfonate	6:2 FTS	27619-97-2
	8:2 Fluorotelomer sulfonate	8:2 FTS	39108-34-4
Perfluorooctane-sulfonamides	Perfluorooctanesulfonamide	FOSA	754-91-6
Perfluorooctane-sulfonamidoacetic acids	N-methyl perfluorooctanesulfonamidoacetic acid	N-MeFOSAA	2355-31-9
	N-ethyl perfluorooctanesulfonamidoacetic acid	N-EtFOSAA	2991-50-6

Appendix H - Laboratory Guidelines for Analysis of PFAS in Non-Potable Water and Solids

General

New York State Department of Environmental Conservation's Division of Environmental Remediation (DER) developed the following guidelines for laboratories analyzing environmental samples for PFAS under DER programs. If laboratories cannot adhere to the following guidelines, they should contact DER's Quality Assurance Officer, Dana Barbarossa, at dana.barbarossa@dec.ny.gov prior to analysis of samples.

Isotope Dilution

Isotope dilution techniques should be utilized for the analysis of PFAS in all media.

Extraction

For water samples, the entire sample bottle should be extracted, and the sample bottle rinsed with appropriate solvent to remove any residual PFAS.

For samples with high particulates, the samples should be handled in one of the following ways:

1. Spike the entire sample bottle with isotope dilution analytes (IDAs) prior to any sample manipulation. The sample can be passed through the SPE and if it clogs, record the volume that passed through.
2. If the sample contains too much sediment to attempt passing it through the SPE cartridge, the sample should be spiked with isotope dilution analytes, centrifuged and decanted.
3. If higher reporting limits are acceptable for the project, the sample can be diluted by taking a representative aliquot of the sample. If isotope dilution analytes will be diluted out of the sample, they can be added after the dilution. The sample should be homogenized prior to taking an aliquot.

If alternate sample extraction procedures are used, please contact the DER remedial program chemist prior to employing. Any deviations in sample preparation procedures should be clearly noted in the case narrative.

Signal to Noise Ratio

For all target analyte ions used for quantification, signal to noise ratio should be 3:1 or greater.

Blanks

There should be no detections in the method blanks above the reporting limits.

Ion Transitions

The ion transitions listed below should be used for the following PFAS:

PFOA	413 > 369
PFOS	499 > 80
PFHxS	399 > 80
PFBS	299 > 80
6:2 FTS	427 > 407
8:2 FTS	527 > 507
N-EtFOSAA	584 > 419
N-MeFOSAA	570 > 419

Branched and Linear Isomers

Standards containing both branched and linear isomers should be used when standards are commercially available. Currently, quantitative standards are available for PFHxS, PFOS, NMeFOSAA, and NEtFOSAA. As more standards become available, they should be incorporated into the method. All isomer peaks present in the standard should be integrated and the areas summed. Samples should be integrated in the same manner as the standards.

Since a quantitative standard does not exist for branched isomers of PFOA, the instrument should be calibrated using just the linear isomer and a technical (qualitative) PFOA standard should be used to identify the retention time of the branched PFOA isomers in the sample. The total response of PFOA branched and linear isomers should be integrated in the samples and quantitated using the calibration curve of the linear standard.

Secondary Ion Transition Monitoring

Quantifier and qualifier ions should be monitored for all target analytes (PFBA and PFPeA are exceptions). The ratio of quantifier ion response to qualifier ion response should be calculated for each target analyte and the ratio compared to standards. Lab derived criteria should be used to determine if the ratios are acceptable.

Reporting

Detections below the reporting limit should be reported and qualified with a J qualifier.

The acid form of PFAS analytes should be reported. If the salt form of the PFAS was used as a stock standard, the measured mass should be corrected to report the acid form of the analyte.

Appendix I - Data Review Guidelines for Analysis of PFAS in Non-Potable Water and Solids

General

These guidelines are intended to be used for the validation of PFAS analytical results for projects within the Division of Environmental Remediation (DER) as well as aid in the preparation of a data usability summary report. Data reviewers should understand the methodology and techniques utilized in the analysis. Consultation with the end user of the data may be necessary to assist in determining data usability based on the data quality objectives in the Quality Assurance Project Plan. A familiarity with the laboratory's Standard Operating Procedure may also be needed to fully evaluate the data. If you have any questions, please contact DER's Quality Assurance Officer, Dana Barbarossa, at dana.barbarossa@dec.ny.gov.

Preservation and Holding Time

Samples should be preserved with ice to a temperature of less than 6°C upon arrival at the lab. The holding time is 14 days to extraction for aqueous and solid samples. The time from extraction to analysis for aqueous samples is 28 days and 40 days for solids.

Temperature greatly exceeds 6°C upon arrival at the lab*	Use professional judgement to qualify detects and non-detects as estimated or rejected
Holding time exceeding 28 days to extraction	Use professional judgement to qualify detects and non-detects as estimated or rejected if holding time is grossly exceeded

*Samples that are delivered to the lab immediately after sampling may not meet the thermal preservation guidelines. Samples are considered acceptable if they arrive on ice or an attempt to chill the samples is observed.

Initial Calibration

The initial calibration should contain a minimum of five standards for linear fit and six standards for a quadratic fit. The relative standard deviation (RSD) for a quadratic fit calibration should be less than 20%. Linear fit calibration curves should have an R^2 value greater than 0.990.

The low-level calibration standard should be within 50% - 150% of the true value, and the mid-level calibration standard within 70% - 130% of the true value.

%RSD >20%	J flag detects and UJ non detects
$R^2 >0.990$	J flag detects and UJ non detects
Low-level calibration check <50% or >150%	J flag detects and UJ non detects
Mid-level calibration check <70% or >130%	J flag detects and UJ non detects

Initial Calibration Verification

An initial calibration verification (ICV) standard should be from a second source (if available). The ICV should be at the same concentration as the mid-level standard of the calibration curve.

ICV recovery <70% or >130%	J flag detects and non-detects
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Continuing Calibration Verification

Continuing calibration verification (CCV) checks should be analyzed at a frequency of one per ten field samples. If CCV recovery is very low, where detection of the analyte could be in question, ensure a low level CCV was analyzed and use to determine data quality.

CCV recovery <70 or >130%	J flag results
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Blanks

There should be no detections in the method blanks above the reporting limits. Equipment blanks, field blanks, rinse blanks etc. should be evaluated in the same manner as method blanks. Use the most contaminated blank to evaluate the sample results.

Blank Result	Sample Result	Qualification
Any detection	<Reporting limit	Qualify as ND at reporting limit
Any detection	>Reporting Limit and >10x the blank result	No qualification
>Reporting limit	>Reporting limit and <10x blank result	J+ biased high

Field Duplicates

A blind field duplicate should be collected at rate of one per twenty samples. The relative percent difference (RPD) should be less than 30% for analyte concentrations greater than two times the reporting limit. Use the higher result for final reporting.

RPD >30%	Apply J qualifier to parent sample
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Lab Control Spike

Lab control spikes should be analyzed with each extraction batch or one for every twenty samples. In the absence of lab derived criteria, use 70% - 130% recovery criteria to evaluate the data.

Recovery <70% or >130% (lab derived criteria can also be used)	Apply J qualifier to detects and UJ qualifier to non detects
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Matrix Spike/Matrix Spike Duplicate

One matrix spike and matrix spike duplicate should be collected at a rate of one per twenty samples. Use professional judgement to reject results based on out of control MS/MSD recoveries.

Recovery <70% or >130% (lab derived criteria can also be used)	Apply J qualifier to detects and UJ qualifier to non detects of parent sample only
RPD >30%	Apply J qualifier to detects and UJ qualifier to non detects of parent sample only

Extracted Internal Standards (Isotope Dilution Analytes)

Problematic analytes (e.g. PFBA, PFPeA, fluorotelomer sulfonates) can have wider recoveries without qualification. Qualify corresponding native compounds with a J flag if outside of the range.

Recovery <50% or >150%	Apply J qualifier
Recovery <25% or >150% for poor responding analytes	Apply J qualifier
Isotope Dilution Analyte (IDA) Recovery <10%	Reject results

Secondary Ion Transition Monitoring

Quantifier and qualifier ions should be monitored for all target analytes (PFBA and PFPeA are exceptions). The ratio of quantifier ion response to qualifier ion response should be calculated from the standards for each target analyte. Lab derived criteria should be used to determine if the ratios are acceptable. If the ratios fall outside of the laboratory criteria, qualify results as an estimated maximum concentration.

Signal to Noise Ratio

The signal to noise ratio for the quantifier ion should be at least 3:1. If the ratio is less than 3:1, the peak is discernable from the baseline noise and symmetrical, the result can be reported. If the peak appears to be baseline noise and/or the shape is irregular, qualify the result as tentatively identified.

Branched and Linear Isomers

Observed branched isomers in the sample that do not have a qualitative or quantitative standard should be noted and the analyte should be qualified as biased low in the final data review summary report. Note: The branched isomer peak should also be present in the secondary ion transition.

Reporting Limits

If project-specific reporting limits were not met, please indicate that in the report along with the reason (e.g. over dilution, dilution for non-target analytes, high sediment in aqueous samples).

Peak Integrations

Target analyte peaks should be integrated properly and consistently when compared to standards. Ensure branched isomer peaks are included for PFAS where standards are available. Inconsistencies should be brought to the attention of the laboratory or identified in the data review summary report.